LIASYS

Service Manual

AMS Analyzer Medical System

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CONFIGURATION SHEET

CHAPTER	DESCRIPTION	REV.
INDEX	TABLE OF CONTENTS	05
01	INTRODUCTION	05
02	SYSTEM DESCRIPTION	05
03	INSTALLATION	05
04	ELECTRICAL SCHEMES AND DRAWINGS	05
05	DIAGNOSTIC PROGRAM	05
06	SETTINGS AND ADJUSTMENTS	05
07	MAINTENANCE	05
08	HOST COMMUNICATION	05
09	ERROR SIGNALING AND TROUBLESHOOTING	05
10	ISE MODULE	05

TABLE OF CONTENTS

- **Chapter 01 INTRODUCTION**
- **Chapter 02 SYSTEM DESCRIPTION**
- **Chapter 03 INSTALLATION**
- **Chapter 04 ELECTRICAL SCHEMES AND DRAWINGS**
- **Chapter 05 DIAGNOSTIC PROGRAM**
- **Chapter 06 SETTINGS AND ADJUSTMENTS**
- **Chapter 07 MAINTENANCE**
- **Chapter 08 HOST COMMUNICATION**
- **Chapter 09 ERROR SIGNALING AND TROUBLESHOOTING**
- **Chapter 10 ISE MODULE**

CHAPTER 01

- INTRODUCTION -

INDEX

1 INTRODUCTION 1

1.1 THE AIM OF THE TECHNICAL MANUAL 2

1.1.2 MANUAL OUTLINE..... 2

1.2 SYSTEM INTRODUCTION 3

1.3 PRECAUTIONARY MEASURES 3

1.3.1 CHEMICAL RISKS 5

1.3.2 ELECTRICAL RISKS 5

1.3.3 MECHANICAL RISKS 4

1.4 GUARANTEE 5

1.5 TECHNICAL OPERATING FEATURES..... 6

1.5.1 COMPUTER & SOFTWARE FEATURES 9

1.5.2 OPTIONS 8

1.5.3 DIMENSIOS, WEIGHT & ENVIRONMENT 10

1.5.4 INSTALLATION REQUIREMENTS 10

1 INTRODUCTION

1.1 THE AIM OF THE TECHNICAL MANUAL

This manual has been written in order to supply the technical staff, the persons who are responsible for the maintenance and for resolving instrument failures, a complete and detailed guide of the Liasys analyzer, in accordanance with the standard UNI EN591 (which requires a manual to be supplied with vitro diagnostic instruments for professional use).

1.1.2 MANUAL OUTLINE

The technical manual is composed of 10 chapters that not only describe the operative technical characteristics of the system, but also the reparation and maintenance procedures to use for the modules that they are composed of.

- **Chapter 1 INTRODUCTION**

  The manual structure is described, and recommendations are given regarding the general use of the analyzer. The technical characteristics of the operative system are given in this chapter.

- **Chapter 2 DESCRIPTION OF THE SYSTEM**

  Describes the system, in particular, the analytical cycle of the single modules and electronic boards.

- **Chapter 3 INSTALLATION**

  Describes the unpacking procedures and the required characteristics for the place of installation.

- **Chapter 4 ELECTRONICS SCHEMES AND DESIGNS**

  Gives the electronics schemes and assembly designs of the electronics board and the assembly designs of the modules that the system is composed of.

- **Chapter 5 DIAGNOSTIC PROGRAM**

  Describes the folders in the Diagnostic Program that are responsible for the checks and the calibration of the modules in the system.

- **Chapter 6 SETTINGS AND ADJUSTMENTS**

  Gives the procedures for substitution, adjustment and check of the system modules.

- **Chapter 7 MANTENANCE**

  Describes the routine maintenance that needs to be done on a regular basis in order to guarantee the correct functioning of the analyzer.

- **Chapter 8 COMUNICATION WITH HOST**

  Describes the communication parameters and the ASTM protocol specifics used by the Liasys system when connecting to the Host Computer.

- **Chapter 9 ERROR SIGNALS AND GUIDE TO RESOLVE ANOMOLIES**

  Lists the system's error signals, describes the errors in the results and gives a guide for how to resolve anomolies.

- **Chapter 10 MODULE ISE**

  This chapter contains information pertaining to the Module ISE, the product description, characteristics and the technical specifics. Furthermore, it describes the maintenance program and gives a guide for how to find failures.

The technical staff responsible for resolving the structural anomolies is highly suggested to thoroughly examine the contents of this manual before operating the system.

1.2 SYSTEM INTRODUCTION

The "Liasys" system is a continuous-load, random access, bench top instrument for performing chemical and immuno-turbo-dymetric clinical analysis. It is totally automatic and computer controlled.

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Manufacturer

1.3 PRECAUTIONARY MEASURES

1.3.1 Chemical risks

The individual operator is responsible for assuring that all possible precautionary measures are taken against eventual risks associated with the use of the "Liasys" instrument in clinical laboratory settings. The manufacturer will provide the reagents kit and specific written information on the use of each of the reagents.

It is important that the samples be well coagulated and then carefully centrifuged.

Samples which contain fibrinogen clots can obstruct the probe and lead to inexact sampling.

If blood samples containing gel are used, it is suggested that the manufacturer's recommendations be followed.

Immediately clean and remove any accidental leakage of reagent or other liquid.

1.3.2 Electrical risks

As with any electrical device, the risk of electric shock exist.

Is therefore necessary to take every precautionary measure possible when working with this, or any other, electrical instrument to avoid contact with power supply wires, electrical components or electronic boards.

1.3.3 Mechanical risks

Several precautionary measures should be taken when operating the analyzer:

avoid wearing very loose clothing or jewelry that could become tangled in the instrument's moving parts (e.g. the sample probe); whenever possible, operate the instrument with the main cover panel lowered.

WARNING: Never attempt to service or substitute any part(s) of the analyzer when the instrument is turned on.

Any and all technical repairs or servicing must be performed by specialized personnel only.

1.4 GUARANTEE

AMS guarantees the substitution of all defective components and/or materials for a period of time not above of 14 months starting from the date of invoicing. Saying guarantee, as well as Technical Assistance, generally is intended furnished as net ex factory Rome.

This guarantee does not include consumable and instrument parts in contact with liquids. All components not included in the guarantee are reported in the following table.

Besides guarantee does not cover damage caused by :

- improper use of the LIASYS instrument (or however not according to the Producer or Seller instructions)
- bad transport
- insufficient (or missing) preventive maintenance by the User

In particular any damages due to the transport must be immediately reported to the carrier when he delivers.

CONSUMABLES AND ACCESSORIES PARTS LIST OUT OF GUARANTEE

Description	**Type**	**Quantity**	**Code**
Reagents bottle	40 ml	30 pieces	9-65-0034-00
Reagents bottle	10 ml	25 "	AS-650121
Glass reagent bottle	7 ml	10 "	AS-900020
Reagents bottle	2 ml	25 "	AS-650122
Conical sample cups	2 ml	1000 "	AS-65-0001
Short sample cups	1 ml	1000 "	AS-65-0100
Washing solution bottle	2 lt	1 "	9-35-0041-00
Kit tubing peristaltic pump		2 "	9-65-0040-00
Reaction cuvettes		60 "	9-65-0031-00
Drying Pad		1 "	9-01-0038-00
Halogen Lamp		1 "	9-35-0016-00
Tubes Kit – complete		1 "	9-65-0027-01
Tygon tubing	1 mt.	1 "	90-01253-00
Kit for E.V.Diluter connection		1 "	99-00906-00
Probe		1 "	9-05-0064-00

Probe new coating		1 "	9-05-0064-01
Micro-Pump Assembly		1 "	9-10-0028-01
Complete Probe Assembly		1 "	9-10-0062-00
Comp Probe Assembly New C		1 "	9-10-0062-01
Diluter head Teflon Fitting		10 "	C1-01-0042-01
Diluter fitting		10 "	C1-01-01222-00
E.V. Rinse fitting		10 "	C190-01254-00
Solenoid Valve		1 "	F-35-0019-00
Micro-Pump (up4) Assy		1 "	05-00403-00
Micro-Pump (up2) Assy		1 "	05-00404-00
Micro-Pump (up3) Assy		1 "	05-00447-00
Manifold Assembly		1 "	05-00405-00
Inlet/Outlet fitting for rinse…		1 "	01-01224-00
Lamps kit		5 "	9-65-0035-00
Na electrode		1 "	35-00814-00
K electrode		1 "	35-00815-00
Cl electrode		1 "	35-00816-00
Reference electrode		1 "	35-00817-00
Peristaltic Pump Tubing-head		1 "	35-00830-00
ISE inlet tubing connection	6 mt	1 "	35-00831-00
O-ring		4 "	35-00832-00

1.5 TECHNICAL OPERATING FEATURES

DESCRIPTION	♦ Fully automatic, random access, continuous loading, benchtop analyzer for clinical chemistry and immunoturbidimetric assays
ASSAY TYPE	♦ End Point, Initial Rate, Kinetic, Bichromatic, Differential,
TEST ENTRY MODE	♦ Selective, Batch, Profiles, STAT
THROUGHPUT	♦ 200 test per hour without ISE module.
WORKING TEMPERATURE	♦ 37° C
ON LINE REAGENTS	♦ 4 removable racks (two racks cooled by Peltier cells and two racks at room temperature). • 33+2 reagent positions of 40 ml or 7 ml each (15 positions at room temperature and 20 cooled) • 14 positions for Standards and Controls
SAMPLE LOADING	♦ 5 racks for continuous loading of samples split in: • 4 racks for 16 positions each. • 1 for 14 positions (STAT) ♦ Continuous loading ♦ Positive barcode reader
REACTION VOLUME	♦ Minimum 300 µl ♦ Maximum 670 µl
SAMPLING ARM	♦ A single mechanical arm provides all sampling operations with: • Capacitive liquid level sensing • Reagent pre-warming at 37° C • Automatic probe washing
DILUTER	♦ Integrated module without syringe with the following specifications: • Sample volume: 3.0 µl ÷ 99 µl (1 µl incr.) • Reagent 1 volume: 3.0 µl ÷500 µl (1 µl incr.) • Reagent 2 volume: 3.0 µl ÷330 µl (1 µl incr.) • Reagent 3 volume: 3.0 µl ÷330 µl (1 µl incr.)
PRECISION	♦ CV < 1 % at 3 µl

READING SYSTEM	♦ Direct Photometry
OPTIC SYSTEM	♦ Photometer: interferential double channel filter wheel ♦ Wavelength: 8 narrow band interferential filters from 340 nm to 620 nm ♦ Light source: halogen lamp 6V/10 W ♦ Linear range: 0.001 ÷ 2.500 Abs ♦ Resolution: 0.0001 Abs
OPTICAL PATH	♦ 10 mm.
WASHING STATION	♦ Composed of five probes that empty, wash and dry the reaction cuvettes.
REACTION PLATE	♦ 60 semi-disposable cuvettes ♦ Cuvettes Q.C. continuously computer controlled ♦ Incubation temperature: 37°C

1.5.1. Computer & Software feature

TYPE	♦ IBM Compatible
CPU	♦ Pentium III 500 MHz, 512 Kb Cache or plus
MEMORY	♦ RAM 128 Mb or plus ♦ Hard Disk 10 Gb or plus ♦ Floppy Disk 3 1/2” 1.44 Mb
MONITOR	♦ Colour SVGA 15’’ low radiation Resolution 800 x 600 pixels; max number of colors 65536 (16 bit)
PRINTER	♦ 80 Columns impact graphic (EPSON LX 300) ♦ PS2
INTERFACE	♦ Two Bi-directional RS 232C serial ports and one parallel
SOFTWARE AVAILABLE LANGUAGES	♦ Multitasking WINDOWS 98 II E ♦ Italian, English, Chinese, Czech. Software to be released soon in these languages: Russian, Portuguese, French, Polish. Upon request it is possible to release the software in other languages.
SETTINGS	♦ Disable all the energy saving options ♦ Disable the screen saver ♦ Select English “USA” as language ♦ Select date and time in Regional setting

NOTE: Even though the computers demonstrate the same technical and operative characteristics, some of these could have different hardware installed.
This could cause problems for the Liasys software when running tests (A message appears indicating "Random" error or blocks the program).
Therefore, if the PC is bought separately/locally, it is highly recommended to test the system at your offices before preceding with the installation at the final client's.
Consequently, AMS denies any responsibility for software problems that are due to buying the computer separately from the instrument.

1.5.2 Options

- **ISE MODULE**
- **POSITIVE BARCODE READER**

1.5.3 Dimensions, Weight & Environment

DIMENSION	♦ Height: 42 cm ♦ Depth: 65 cm ♦ Length: 100 cm
WEIGHT	♦ 65 Kg
OPERATING ENVIRONMENT	♦ Temperature: 18°C ÷ 32°C. ♦ Relative humidity: 20% ÷ 85%

1.5.4 Installation requirements

POWER REQUIREMENTS	♦ Input Voltage 90 ÷ 250 Vac ♦ Input Frequency: 47 ÷ 63 Hz ♦ Power consumption: ♦ 300 W for the analytical unit ♦ 400 W for the work station
SAFETY REGULATIONS	♦ EN 61010-1:1993 +A2:1995 (in compliance with the main European safety directives 73/23/CEE e 3/68/CEE)

ELECTROMAGNETIC COMPATIBILITY	♦ EMC 89/336/CEE – 92/31/CEE Directives ♦ EN 55011, Class B, Group 1 ♦ EN 50081-1:1992 EMC ♦ EN 55022 ♦ ENV 50140 – ENV 50141 ♦ EN 60601-1-2 ♦ EN 61000-4

Warning: A steady power supply (+ 10%) must be provided for the instrument.

If it is not, the manufacturer highly recommends the use of:

- **UPS** Uninterruptible Power Supply (No-break module)
- **ELECTRONIC STABILISER**

CHAPTER 02

– SYSTEM DESCRIPTION -

INDEX

2 DESCRIPTION OF THE SYSTEM 3
2.1 ANALYSES CYCLE 4
2.1.1 REACTION PLATE 4
2.1.2 REACTION PLATE CYCLE 4
2.2 SAMPLING ARM - OPERATIONAL SEQUENCE 5
2.3 WASH STATION 7
2.3.1 WASH STATION CYCLE 7
2.4 ELECTRICAL SCHEMES DESCRIPTION 8
2.4.1ANALYTICAL CONTROL BOARD (CPU) P/N 00195-01 8
2.4.2 INTRODUCTION 8
2.4.3 GENERAL CHARACTERISTICS 8
2.4.4 CIRCUIT DESCRIPTION 8
2.4.5 POWER SUPPLY 8
2.4.6 MICRO-CONTROLLERS AND BUFFER 9
2.5 PROGRAMMABLE LOGIC 14
2.5.1 FLASH PROGRAMMING VOLTAGE 15
2.5.2 SERIAL INTERFACES 15
2.5.3 CLOCK 16
2.5.4 LED 17
2.5.5 BUZZER 17
2.6 STEPPER MOTORS DRIVER BOARD P/N 00188-01 17
2.6.1 INTRODUCTION 17
2.6.2 GENERAL CHARACTERISTICS 17
2.6.3 CIRCUIT DESCRIPTION 17
2.6.4 POWER SUPPLY 17
2.6.5 STEPPER MOTORS DRIVER 18
2.6.6 OPEN COLLECTOR DRIVERS 19

2.7 TA 8435 H ……..19
2.7.1 INTRODUCTION 19
2.7.2 MICRO-STEP PILOTING 19
2.7.3 CONTROL OF PULSE WIDTH MODULATION AND OUTPUT CURRENT 20
2.7.4 CONTROL LOGIC 21
2.7.5 1/2 STEP PILOTING 21
2.8 SAMPLING INTERFACE ASSY P/N 00192-01 21
2.8.1 SAMPLING INTERFACE ASSY P/N 00192-01 22
2.9 LEVEL SENSOR BOARD 1-2 P/N 30-0005-XX 23
2.10 REACTION TRAY INTERFACE P/N 00193-01 23
2.11 REACTION TRAY INTERFACE P/N 00193-01 24
2.12 REACTION CHAMBER MOTOR INTERFACE P/N 00341-00 25
2.13 PRE-AMPL/ADC P/N 00107-00 25
2.14 PHOTOMETER LAMP PWS P/N 30-0004-00 25
2.15 SAMPLE RACKS IDENTIFICATION BOARD P/N 00446-00 26
2.16 CONTROL PANEL P/N 00342-00 26
2.17 HYDRAULICS INTERFACE BOARD P/N 00419-00 26

2 DESCRIPTION OF THE SYSTEM

"Liasys" is a random access, counter-top, computer controlled clinical analysis instrument.
The system can perform 200 tests per hour and has a machine cycle of 18 sec. Its execution time ranges from a minimum of 48 sec to a maximum of 756 sec, depending on the analysis method chosen.
The first time the system is used for normal laboratory analyses, the operator must configure the system based on the specific needs of that laboratory; i.e.: the chemical parameters; the reagents racks and the normal, calibrated and control values must all be defined.
The daily routine analyses will be carried out according to patient sample arrival in a sequential and continuous, non-stop manner.
The work list is organized using a loading rack holding 16 patient samples plus a STAT rack for 14 patient samples. Rack loading is non-stop.
The racks can accommodate both test tubes and micro caps. The bar code for primary tubes is optional.
When the system is first turned on, the analytical unit, the computer and the color-meter lamp are supplied with low voltage power (1.2 volts). The sampling arm pre-heater is turned off while the reaction plate heater, the reagents refrigerating unit and the electronic components are turned on. The "Stand-by" light, placed on the front panel will flash until the reaction plate reaches a temperature of 36° C. At this point, the "Stand-by" light will stop flashing and will remain constantly lit.
In the case of system failure or malfunction, the "Ready" light, situated on the front panel of the instrument, will light up red.
In order to enter the main program, double click on the *"Liasys"* icon on the computer desktop.
The main menu - "System Monitor" - will appear.
Whenever any system function is launched, the color-meter lamp and the sampling arm pre-heater will receive regular power.

2.1 ANALYSES CYCLE

2.1.1 REACTION PLATE

The reaction plate of the *"Liasys"* system contains 60 washable and reusable, plastic cuvettes. The cuvettes can be removed individually.
Cuvette washing takes place under the reaction plate washing station. There are five positions which alternate in the washing and drying of the cuvettes.
The basic operating cycle of the reaction plate takes 18 seconds. Said cycle includes: optic reading of the cuvettes in incubation, aspiration and dispensation of the reagents and samples by the arm, repositioning of the plate and washing of the cuvettes.
The reactions take place at 37° C. this temperature is constantly maintained by the heater placed under the reaction plate.

2.1.2 REACTION PLATE CYCLE

After reagents and samples have been placed in cuvette #1, the reaction plate will rotate counter-clockwise to position #31 so as to bring the first cuvette to be analyzed in front of the color-meter for reading with one or two wavelengths as required.
The plate will then, moving counter-clockwise, carry out all the readings of any other prepared cuvettes. After having effected all the readings, the plate will move clockwise to its initial position minus one cuvette, ready for a new dispensing.
Therefore, the reaction cuvettes will move clockwise 1 - 2 - 3 – 4 for their dispensation and washing, and counter-clockwise 4 - 3 - 2 - 1 for their reading.

2.2 SAMPLING ARM - OPERATIONAL SEQUENCE

1. The sampling arm lifts up from the washing well and carries out a washing cycle.

2. The arm moves toward the specific reagent container, while the diluter aspirates an air bubble to separate the rinse column from the reagent.

3. The arm descends into the reagent to the level indicated by the sensor and aspirates the required volume of reagent.
   If the method requires a line prime volume, an extra amount of reagent (not used in the analysis) will be aspirated before the quantity of reagent necessary for the analysis along with a smaller air bubble for separation.

4. While the diluter aspirates a second air bubble, the arm rises and then lowers into the wash well so that it can be washed externally, to minimize cross contamination.

5. The arm moves to the specified sample and aspirates a third air bubble.

6. When the level sensor senses the liquid, the arm stops and aspirates the sample.

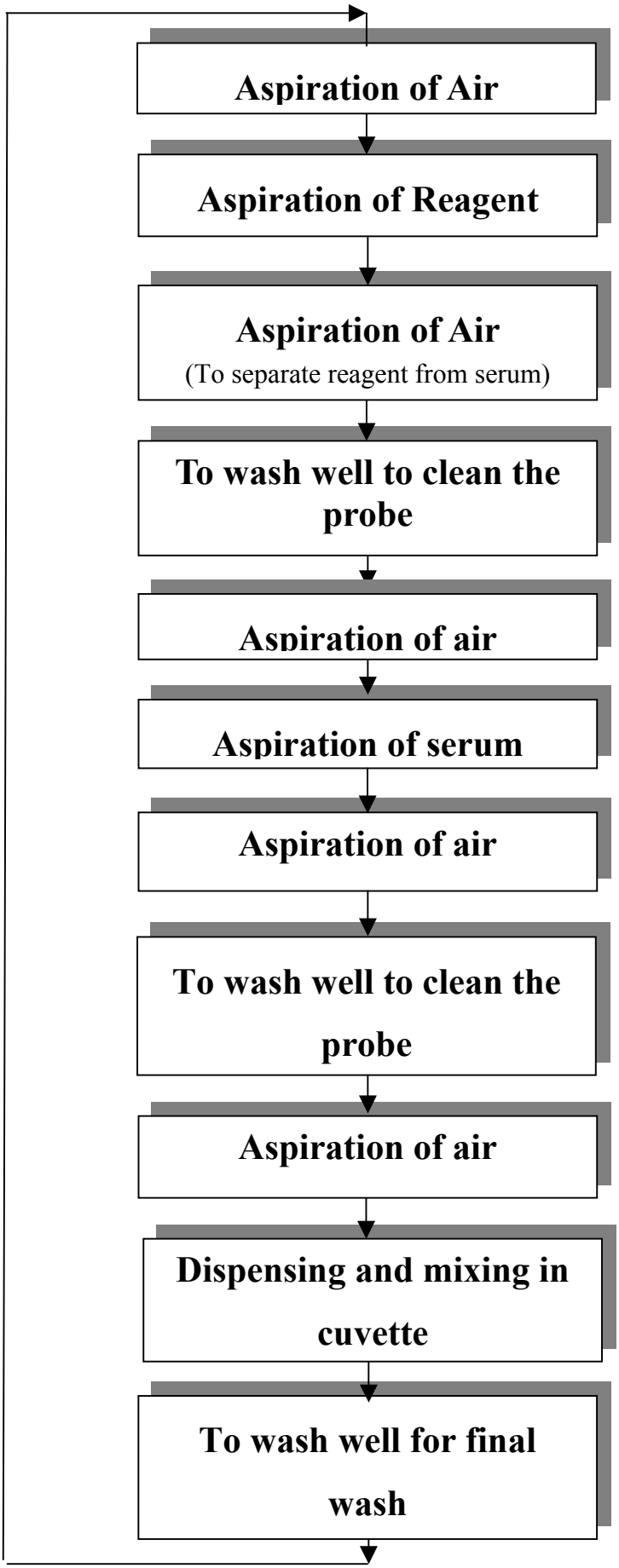
7. The arm rises once again, while the diluter aspirates a fourth air bubble to prevent sample loss.

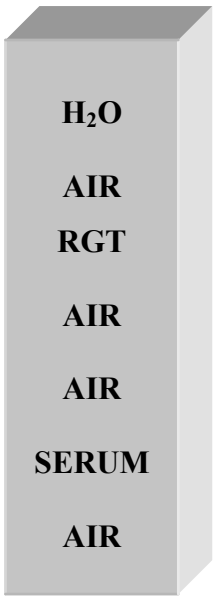
8. At this point, the arm returns to the wash well in order to clean the outside of the probe and it aspirates a fifth air bubble.

9. The arm moves to the reaction plate and dispenses reagent and sample in the reaction cuvette for incubation and reading.

10. The arm returns to the wash well and carries out a probe wash cycle.

SAMPLING SYSTEM


Aspiration of Air
Aspiration of Reagent
Aspiration of Air
(To separate reagent from serum)
To wash well to clean the probe
Aspiration of air
Aspiration of serum
Aspiration of air
To wash well to clean the probe
Aspiration of air
Dispensing and mixing in cuvette
To wash well for final wash



2.3 WASH STATION

The reaction plate wash station is made up of a series of five small flags situated on one side of the reaction plate. Said flags are opportunely connected to the valve and pump system for emptying, washing and drying operations (please see the hydraulic diagram).

2.3.1 WASH STATION CYCLE

The wash station carries out its operations alternating upward and downward movement. In its downward movement phase the flags are guided in such a manner as to carry out the following operations:

- The first flag, using the central cannula, removes the reaction mix while the external cannula dispenses, shower-like fashion, the wash solution (this operation is repeated twice);
- The second flag operates exactly like the first but uses distilled water instead and repeats the operation three times;
- The third flag dispenses distilled water into the cuvette so that an optics check can be performed (if the results are negative, the cuvette is discarded);
- The fourth flag aspirates the control water;
- The fifth flag dries the sides.

All these operations are part of the routine operation of the instrument. Every reaction cuvette is washed at the end of each round of analysis.

The reusability (optical integrity) of each reaction cuvette is always tested before the next round of analysis.

2.4 ELECTRICAL SCHEMES DESCRIPTION

2.4.1ANALYTICAL CONTROL BOARD (CPU) P/N 00195-01

2.4.2 INTRODUCTION

The ANALYTICAL CONTROL BOARD (C. P. U.), integrated in the LIASYS system is the heart of the low level, real time, processing management.

2.4.3 GENERAL CHARACTERISTICS

The board has been designed to be a generic control of input/output, governed by an external C.P.U. or by an internal PC board based platform, in light of possible different future instrument configurations.

2.4.4 CIRCUIT DESCRIPTION

The following description refers to the [SE]00195-01 Rev. C. electrical wiring diagram.

2.4.5 POWER SUPPLY

- The main power supply VM (24V), filtered by C10 and C12, is taken up via connector J6 and used to generate the +5 volts; moreover, it is brought back on connectors J9 and J10 to 25 pins
- The 5V is obtained through U4 (LM2575), the Schottky D5 diode, the L1 inductance and condensers C14 and C15: the entire circuit makes up a step down converter - from 24V to 5V - with 1 Ampere of current.
- Said power supply is brought back on connector J6 forecasting the possibility that it could come directly from an external power source (in this case the step-down components are not mounted, with the exclusion of the C14 and C15 condensers).
- A second power supply, 12.5V, filtered via C9 and C11 is taken up via connector J6, in addition to being brought back on connectors J9 and J10 to 25 pins and on connectors J13 and J14 to 10 pins and utilized to generate the 12V for the two flash memories inside the two U1 and U2 microprocessors and the AVCC.

AVCC (5V) used for the operational U23 and U24 and also for the two microprocessors' internal A/D converters.

2.4.6 MICRO-CONTROLLERS AND BUFFER

In order to quickly and most efficiently manage all the devices, there are two independent micro-controllers, U1 and U2. Each sends input and output signals to the relative connectors.
All signals which begin with the letter 'P' refer to the Micro 'P' (U1), while those which begin with the letter 'R' refer to the Micro 'R' (U2).

The two Micros are HITACHI H8/3048, configured in operative mode 7, single chip. Following are some basic performance features:

- elevated speed in carrying out instruction (2 clock cycles at 16 MHz equal to 125 ns to carry out an addition or subtraction operation between 2 registers);
- 128 KBYTES flash memory;
- 4 KBYTES RAM;
- 70 I/0 signals, almost all having more than one function, plus 8 input only.
- All signals are buffered in input or in output:
- the buffer for the T.T.L. signals is 74HC244;
- the driver for the open-collector signals is ULN2803;
- the operational amplifier LM324 is used for the analogic signals.

The following two tables list the 78 Micro 'P' and Micro 'R' signals. For each the following are specified:

- the name of the signal on the pin of the Micro (e.g.: P30)
- the type: I for output. 0 for input;
- the buffer used for the input or the output (e.g.: U7);
- the connector onto which the signal is sent (e.g.: J5);
- the name of the buffer input signal (if in input) or at buffer output (if in output);
- a brief description of functioning (e.g.: Motor A enable).

TAB.1 Micro 'P' Signals

Micro Signal	I/O	Buffer	Conn.	Signal Connector	Function
P10	I/O			R14	Synchronization 1 micro 'R'
P11	I/O			R15	Synchronization 2 micro 'R'
P12	I/O			R16	Synchronization 3 micro 'R'
P13	I	U21	J9/11	PINP	Generic
P14	I/O			R10	Synchronization 1 micro 'P'
P15	I/O			R11	Synchronization 2 micro 'P'
P16	I/O			R12	Synchronization 3 micro 'P'
P17	O	U17	J9/14	PDAR1	Pump Diluter
P20	I	U15	J7/21	PINP1	Sample rack 1 in place
P21	I	U15	J7/23	PINP2	Sample rack 2 in place
P22	I	U15	J7/25	PINP3	Sample rack 3 in place
P23	I	U15	J17/1	PINP4	Sample rack 4 in place
P24	I	U15	J17/3	PINP5	Sample rack 5 in place
P25	I	U15	J17/5	PINP6	Sample door switch
P26	I	U15	J17/7	PINP7	Stat door switch
P27	I	U15	J17/9	PINP8	Sample button
P30	O	U7	J7/2	PENA	Motor A enable
P31	O	U7	J7/4	PENB	Motor B enable
P32	O	U7	J7/6	PENC	Motor C enable
P33	O	U7	J7/8	PEND	Motor D enable
P34	O	U7	J7/10	PDIRA	Motor A c.w./c.c.w.
P35	O	U7	J7/12	PDIRB	Motor B c.w./c.c.w.
P36	O	U7	J7/14	PDIRC	Motor C c.w./c.c.w.
P37	O	U7	J7/16	PDIRD	Motor D c.w./c.c.w.
P40	O	U9	J7/1	PUT1	ST-BY lamp button (Control Panel)
P41	O	U9	J7/3	PUT2	SAMPLE lamp button (Control Panel)
P42	O	U9	J7/5	PUT3	STAT lamp button (Control Panel)
P43	O	U9	J7/7	PUT4	READY lamp button (Control Panel)
P44	O	U9	J7/9	PUT5	Not used
P45	O	U9	J7/11	PUT6	Not used
P46	O	U9	J7/13	PUT7	Not used
P47	O	U9	J7/15	PUT8	Not used
P50	O	U8	J7/18	PPDA	Motor A power down function
P51	O	U8	J7/20	PPDB	Motor B power down function
P52	O	U8	J7/22	PPDC	Motor C power down function
P53	O	U8	J7/24	PPDD	Motor D power down function
P60	O	U14	J7/17	PUT9	Reserved 1
P61	O	U14	J7/19	PUT10	Reserved 2
P62	O	U21	J9/1	PG1	ADC1 gain A
P63	O	U21	J9/5	PG2	ADC2 gain B
P64	O	U21	J9/23	PSCLK	ADC1-ADC2 serial clock
P65	O	U21	J9/10	PTTL	Not used

P70	I	U23A	J17/10	PAN1	External temperature N.T.C. sense
P71	I	U23B	J9/16	PAN2	Preheater current sense
P72	I	U23C	J9/25	PAN3	Preheater N.T.C. sense
P73	I	U23D	J13/9	PAN4	Reagent N.T.C. sense
P74	I	U16	J9/3	PFOTO1	Optosensor 1 signal
P75	I	U16	J9/7	PFOTO2	Optosensor 2 signal
P76	I	U16	J9/9	PFOTO3	Optosensor 3 signal
P77	I	U16	J9/17	PFOTO4	Optosensor 4 signal
P80	I	U14	J17/11	PINP9	Stat button
P81	I	U14	J17/13	PINP10	Ready button
P82	I	U14	J17/15	PINP11	St-by button
P83	I	U14	J17/16	PINP12	Liquid 1 alarm
P84	I	U14	J17/12	PINP13	Liquid 3 alarm
P90	O	U25	J1/1	P90OUT	Auxiliary TX
P91	O	U25	J11/3	X91	RS232 TX
P92	I	U25	J1/3	P92IN	Auxiliary RX
P93	I	U25		X93	RS232 RX
P94	I	U16	J9/8	PRDY2	ADC2 data ready
P95	I	U16	J9/15	PRDY1	ADC1 data ready
PA0	I	U6	J13/8	POSR1	Optosensor reagent 1 signal
PA1	I	U6	J13/7	POSR2	Optosensor reagent 2 signal
PA2	O	U8	J7/26	PCLKA	Motor A clock
PA3	I	U6	J13/6	POSR3	Optosensor reagent 3 signal
PA4	O	U8	J17/2	PCLKB	Motor B clock
PA5	I	U6	J13/5	POSR4	Optosensor reagent 4 signal
PA6	O	U21	J9/21	PPWM	Preheater P.W.M.
PA7	O	U17	J13/4	PDAR2	Air pump
PB0	O	U8	J17/6	PCLKD	Motor D clock
PB1	I	U21	J9/6	PLEAK	Sampling leak assy
PB2	O	U8	J17/4	PCLKC	Motor C clock
PB3	I	U16	J9/24	PADC1	ADC1 digital output
PB4	I	U21	J9/4	PSLI	Level sensor
PB5	I	U16	J9/2	PADC2	ADC2 digital output
PB6	I				MICRO P address
PB7	I	U14	J17/14	PINP14	Liquid 2 alarm

TAB.2 Micro 'R' Signals

Micro Signal	I/O	Buffer	Conn.	Signal Connector	Function
R10	I/O			P14	Synchronization 1 micro 'P'
R11	I/O			P15	Synchronization 2 micro 'P'
R12	I/O			P16	Synchronization 3 micro 'P'
R13	I	U22	J10/11	RINP	Power led opto (3)
R14	I/O			P10	Synchronization 1 micro 'R'
R15	I/O			P11	Synchronization 2 micro 'R'
R16	I/O			P12	Synchronization 3 micro 'R'
R17	O	U17	J10/14	RDAR1	Diluter pump
R20	I	U19	J8/21	RINP1	Leak
R21	I	U19	J8/23	RINP2	Interlock
R22	I	U19	J8/25	RINP3	Not used
R23	I	U19	J18/1	RINP4	Not used
R24	I	U19	J18/3	RINP5	Not used
R25	I	U19	J18/5	RINP6	Not used
R26	I	U19	J18/7	RINP7	Not used
R27	I	U19	J18/9	RINP8	Not used
R30	O	U13	J8/2	RENA	Motor A enable
R31	O	U13	J8/4	RENB	Motor B enable
R32	O	U13	J8/6	RENC	Motor C enable
R33	O	U13	J8/8	REND	Motor D enable
R34	O	U13	J8/10	RDIRA	Motor A c.w./c.c.w.
R35	O	U13	J8/12	RDIRB	Motor B c.w./c.c.w.
R36	O	U13	J8/14	RDIRC	Motor C c.w./c.c.w.
R37	O	U13	J8/16	RDIRD	Motor D c.w./c.c.w.
R40	O	U11	J8/1	RUT1	EV1 valve
R41	O	U11	J8/3	RUT2	EV2 valve
R42	O	U11	J8/5	RUT3	EV3 valve
R43	O	U11	J8/7	RUT4	EV5 valve
R44	O	U11	J8/9	RUT5	Cover lock
R45	O	U11	J8/11	RUT6	MP2 pump
R46	O	U11	J8/13	RUT7	MP3 pump
R47	O	U11	J8/15	RUT8	MP4 pump
R50	O	U12	J8/18	RPDA	Motor A power down function
R51	O	U12	J8/20	RPDB	Motor B power down function
R52	O	U12	J8/22	RPDC	Motor C power down function
R53	O	U12	J8/24	RPDD	Motor D power down function
R60	O	U20	J8/17	RUT9	Reserved 1
R61	O	U20	J8/19	RUT10	Reserved 2
R62	O	U22	J10/1	RG1	ADC1 gain A
R63	O	U22	J10/5	RG2	ADC2 gain B
R64	O	U22	J10/23	RSCLK	ADC1-ADC2 serial Clock
R65	O	U22	J10/10	RTTL	Lamp off

R70	I	U24A	J18/10	RAN1	External temperature N.T.C. sense
R71	I	U24B	J10/16	RAN2	Plateheater current sense
R72	I	U24C	J10/25	RAN3	Plate N.T.C. sense
R73	I	U24D	J14/9	RAN4	Not used
R74	I	U18	J10/3	RFOTO1	Optosensor 1 signal
R75	I	U18	J10/7	RFOTO2	Optosensor 2 signal
R76	I	U18	J10/9	RFOTO3	Optosensor 3 signal
R77	I	U18	J10/17	RFOTO4	Optosensor 4 signal
R80	I	U20	J18/11	RINP9	Not used
R81	I	U20	J18/13	RINP10	Peristaltic pump A sense
R82	I	U20	J18/15	RINP11	Peristaltic pump B sense
R83	I	U20	J18/16	RINP12	Not used
R84	I	U20	J18/14	RINP13	Not used
R90	O	U25	J3/1	R90OUT	Auxiliary TX
R91	O	U25	J11/3	X91	RS232 TX
R92	I	U25	J3/3	R92IN	Auxiliary RX
R93	I	U25		X93	RS232 RX
R94	I	U18	J10/8	RRDY2	ADC2 data ready
R95	I	U18	J10/15	RRDY1	ADC1 data ready
RA0	I	U6	J14/8	ROSR1	Not used
RA1	I	U6	J14/7	ROSR2	Not used
RA2	O	U12	J8/26	RCLKA	Motor A clock
RA3	I	U6	J14/6	ROSR3	Not used
RA4	O	U12	J18/2	RCLKB	Motor B clock
RA5	I	U6	J14/5	ROSR4	Not used
RA6	O	U22	J10/21	RPWM	Plateheater P.W.M.
RA7	O	U17	J14/4	RDAR2	Not used
RB0	O	U12	J18/6	RCLKD	Motor D clock
RB1	I	U22	J10/6	RLEAK	Leak plate assy
RB2	O	U12	J18/4	RCLKC	Motor C clock
RB3	I	U18	J10/24	RADC1	ADC1 digital output
RB4	I	U22	J10/4	RSLI	Not used
RB5	I	U18	J10/2	RADC2	ADC2 digital output
RB6	I				Micro ‘R’ address
RB7	I	U20	J18/12	RINP14	Not used

2.5 PROGRAMMABLE LOGIC

It is made up of U10 (PAL 16V8) and has the following functions:

- Reset generation for the two Micros:
  Each Micro is reset: if RESA is present, generated by U5 (DS1233-10), when downloading begins (RESB signal) or for the entire length of program downloading of the other Micro (BOOT and SELP signals, the latter is provided by the first serial connector J2).

The relative equations in PALASM format are:

/RESP = /RESA + RESB + BOOT * /SELP

/RESR = /RESA + RESB+ BOOT * SELP

- Generation of X91 associated with one of two TX lines (Micro 'P' P91 and Micro 'R' R91) to be directed toward the PC both in the operative phase and in the BOOT phase.
  R91 is chosen if SELP is low (downloading phase Micro 'R') or if R10 is low (operative phase in which Micro 'R', after ascertaining that the channel is free, wants to transmit): in all other cases X91 brings back P91.

The corresponding equation in PALASM format is:

/X91 = /SELP * /R91 + SELP * (/R91 * /R10 + /P91 * R10)

- Generation of the signals for programming the Micro 'R' flash
  Activate PMD2E in the BOOT phase if SELP is high or in the operative phase if Micro 'P' wants to write in flash (low P66);
  Activate PVPPE in the BOOT phase if SELP is high;
  Activate RMD2E in the BOOT phase if SELP is low or in the operative phase if Micro 'R' wants to write in flash (low R66);
  Activate RVPPE in the BOOT phase if SELP is low.

The relative equations in PALASM format are:

PMD2E = /P66 + BOOT * SELP

PVPPE = BOOT * SELP

RMD2E = /R66 + BOOT * /SELP

RVPPE = BOOT * /SELP

2.5.1 FLASH PROGRAMMING VOLTAGE

The PMD2E, PVPPE, RMD2E, RVPPE signals pilot 4 U17 Darlingtion sections, whose outputs (PEMD2, PEVPP, REMD2, REVPP signals) activate, respectively, the PNP Q2, Q3, Q1 and Q4 transistors which bring back the 12V respectively on pin MD2 and pin VPP of Micro 'P' and Micro 'R'.

2.5.2 SERIAL INTERFACES

The first serial of each Micro (signals P90 and P92 for Micro 'P'; R90 and R92 for Micro 'R') is dedicated to communicating with its own auxiliary device (respectively J1 and J3).

For the reception channel of the second serial:

- Micro 'P' is linked to serial 1 of the PC (P93←→RX).
- Micro 'R' can be:
  - linked to serial 2 of the PC (R93 ←→ RX2 coming from J5) shifting the tin soldered jumper from pins 2-3 of J12 to pins 2-1
  - linked in parallel with those of Micro 'P' and therefore linked to series 1 of the PC (R93 ←→ RX :tin soldered jumper on pins 2-1 f J12).

For the transmission channel of the second serial:

- Micro 'R' is linked to serial 2 of the PC (R91 ←→ TX2).
- Micro 'P' can:
  - be linked to serial 1 of the PC (P91 ←→ TX) shifting the tin soldered jumper from pins 2-3 of J11 to pins 2-1
  - share the transmission to the PC with the other Micro (tin soldered jumper on pins 2-1 of J11). In this case the arbitration between the two Tx signals is carried out in the BOOT phase via the SELP signal and in the operative phase via the R10 and P1 signals which the two Micros exchange and which respectively receive on signals P14 and R14 everything governed by programmable logic).

The two Micros carry out program downloading via J2: in addition to the TX and RX signals also the following signals are utilized for this function:

- SELP which goes directly on the programmable logic and which if low, signals that it wants to load the program on Micro 'R'.

- RTS and DTR which after the RS232-TTL conversion become BOOT and RESB and are brought back on the programmable logic for reset generation and for enabling the programming voltage for Micros 'P ' and 'R'.
  The same program is loaded on the two Micros.
  In the operative phase, the format of the communication messages with the PC contains an address 'number':
- '1' for those messages which can be processed only by Micro 'P', recognized because the PB6 input is high;
- '2' for those messages which can be elaborated only by Micro 'R', recognized because the RB6 input is low.

The four TTL-RS232 conversions:

- P90-P90OUT: transmission toward Micro 'P's auxiliary device;
- R90-R90OUT: transmission toward Micro 'R's auxiliary device;
- R91-TX2: transmission toward Micro 'R's PC,
- TX5V TX: transmission toward either Micro 'P's or Micro 'R's PC,

and the four RS232-TTL conversions:

- P92IN-P92: reception from the auxiliary device for Micro 'P';
- R92IN-R92: reception from the auxiliary device for Micro 'R';
- RX2-R93: reception from the PC for Micro 'R';
- RX-P93-R93: reception from the PC for Micros 'P' and 'R'
  are carried out through the U25 and U26 (MAX202) devices.

2.5.3 CLOCK

The system clock is supplied by quartz at 16MHz X1 connected to the Micro 'P' internal oscillator pins EXTAL and XTAL: output TTL of this oscillator (U1/61) is brought back on input XTAL of the Micro 'R' oscillator.

2.5.4 LED

There are two LEDs

- LD1: green LED for VM presence
- LD2: green LED for +12.5V presence.

2.5.5 BUZZER

The acoustic signals are channeled to the LS1 buzzer and can be activated via the PDAR2 and/or RDAR2 signals of the two Micros.

2.6 STEPPER MOTORS DRIVER BOARD P/N 00188-01

2.6.1 INTRODUCTION

The "STEPPER MOTORS DRIVER BOARD" is the interface between the control board and the stepper motors.

2.6.2 GENERAL CHARACTERISTICS

This board has been designed to be used in various systems or sub-groups which require mechanical movement .

It can manage up to four stepper motors and has an open collector (Darlington) interface for 16 signals, whose output can be sent to various devices including electro-valves, continuous current motors.

2.6.3 CIRCUIT DESCRIPTION

The following description refers to the [SE]00188-01 Rev.B. electrical wiring diagram

2.6.4 POWER SUPPLY

The main power supply, VM (24 V), applied via J3 and indicated by the lit green D22 LED, is used for the stepper driver power portion (TA8435H).

The secondary power supply, 12.5 Volts, also comes through connector J3, is filtered by condenser C13, monitored via the green D21 LED and used to generate the 5 Volts necessary for the stepper driver logic section and for the pull-up resistors.

The 5 volts are obtained from the 12.5 Volts through U5 (LM7805) and the C14 filter condenser.

2.6.5 STEPPER MOTORS DRIVER

The four drivers are represented by the U1, U2, U3 and U4 components.

Following is a description of the functioning of the first (U1) of the four identical circuits.

Later on in this manual a brief description of the functioning of the NMB SDI-C403 device or TOSHIBA's equivalent TA8435H will be provided.

The driver under examination is made up of:

A logic section for decoding signals arriving from the control board, via the J4 and J7 connectors, which uses the following inputs:

DIRA (pin 5): determines the direction of the rotation of the motor;

RES (pin 2): reset;

CLKA (pin 6): controls phase excitation frequency: the pilot mode depends on the M1A (pin 8) and M2A (pin 9) inputs, set via the SW1DIP SWITCH according to the following table:

M2A	M1A	Function
0(on)	0(on)	1 full step
0(on)	1(off)	1/2 step
1(off)	0(on)	1/4 step (default setting)
1(off)	1(off)	1/8 step

Please note that the other clock input (pin 7) is connected to the +5 volts.

Use of the 1/4 and 1/2 steps, with respect to the full step, make it possible to lessen vibration and improve positioning accuracy.

A power section, (made up of 2 H-shaped bridges), that generates the voltage to be applied to the two stepper motor windings (AM62, AM62N, BM62, and BM62N respectively on pins 23, 20, 19, and 16) on connector J1.

The latter are supplied when the RES signal is high and the ENA signal (coming from the control board, via connector J4) is at a low logic level.

The state of the ENA signal level, and therefore that of the relative Stepper Motor driver, is indicated by the yellow D17 LED.

The D1, D3, D5 and D7 Schottky diodes are to protect the internal power circuits.

A power control and monitoring section which, via the C5 (3.3nF) condenser generates a circa 60 kHz internal oscillation frequency used to control the Pulse Width Modulation (PWM).
Said control is affected by:
the voltage levels, produced by the potential drop on the R1 and R2 power resistors, present on pins 21 and 18;
the PDA (pin 10) signal, arriving from the control board (via connector J4), which conditions the internal switching logic intervention threshold; to 0.8 volts if it is kept at a high logic level and 0.5 volts if at a low logic level.

2.6.6 OPEN COLLECTOR DRIVERS

Two integrated circuits are present on the board, U6 and U7 (ULN2803), and constitute an open collector interface for 16 signals:
10 of which come from the control board (UT1…UT10) via J4 with their outputs connected to J2;
6 gathered via J5 and placed in output on J6.
These outputs are used to pilot various types of power devices: continuous current motors, solenoids, electrovalves, etc.

2.7 TA 8435 H

2.7.1 INTRODUCTION

TA 8435 H controls the PWM for setting the current of the Stepper Motor windings to a constant value. The device is an integrated circuit for micro-step piloting, used in order to have an efficient and low vibration control over the Stepper Motors.

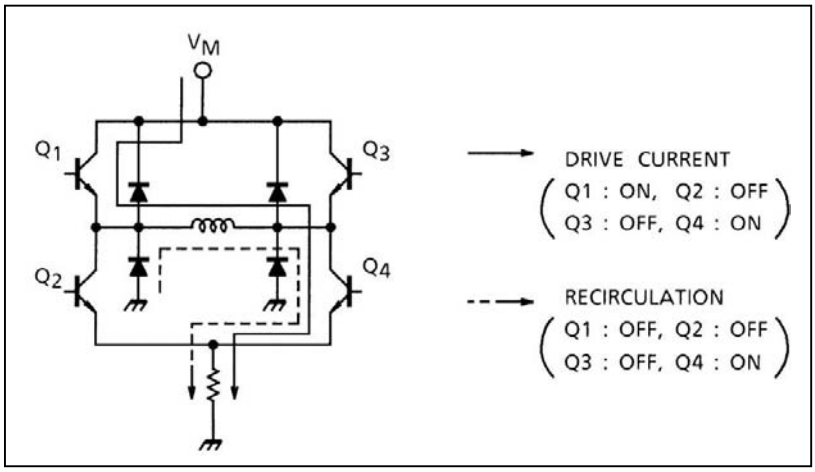
2.7.2 MICRO-STEP PILOTING

TA 8435 H controls a Stepper Motor in micro-steps; with a maximum resolution of 1/8 of a step. The current levels of the A and B phases are regulated in micro-steps within the integrated circuit in such a manner that the size and rotation angle of the vector between the micro-steps remains constant. When the clock signals are placed in input (CK1, CK2), the Stepper Motor will rotate in micro-steps.

2.7.3 CONTROL OF PULSE WIDTH MODULATION AND OUTPUT CURRENT

Output current pathway flow diagram (PWM control)

TA 8435 H controls PWM, placing the upper transistor in an on/off switching mode. In this case current flow is as illustrated below:



Control of the output current via the detection resistor of the output and input current REF-IN: the motor current (maximum current for micro-step piloting I∅), is regulated as shown in the following equation, using the REF-IN in-put and the detection resistor of the external current RNF:

$$I\varnothing = V_{REF} / R_{NF}$$

Where:

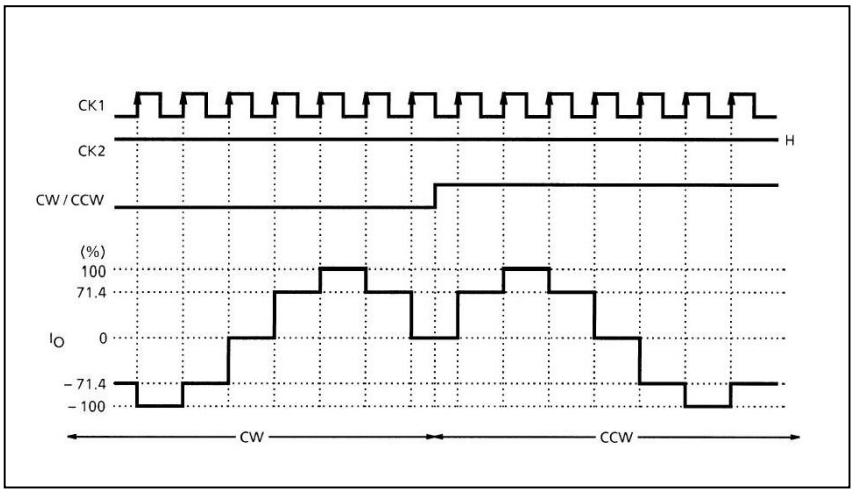
for REF-IN = HIGH $\Rightarrow$ $V_{REF} = 0.8$ V

for REF-IN = LOW $\Rightarrow$ $V_{REF} = 0.5$ V

2.7.4 CONTROL LOGIC

Clock input for rotation direction control

To switch the rotation direction from forward to backward there are two clock inputs: CK1 and CK2, and input CW/CCW and the first of the two control methods are shown in the diagram below:



2.7.5 1/2 STEP PILOTING

The selection between: full step, 1/2 step. 1/4 step and 1/8 step, is carried out with binary coding on the two M1 and M2 inputs.

2.8 SAMPLING INTERFACE ASSY P/N 00192-01

The "Sampling Interface Assy" board (code 00192-01) controls the arm, the diluter, the pre-heater and wash well leakage.

The Home Sensors (vertical, external arm, internal arm and diluter) are connected to the board via the J9, J10, J11 and J13 connectors.

The Vertical Home, External Arm Home and Internal Arm Home LEDs are placed in series with their power absorption control via the ALFD3 signal, connected to J2 Pin 11 that reports information on the Analytical Control Board (CPU).

Information from the leakage sensor enters on the J12 connector, is processed by U1A, exits on J2 Pin 6 and arrives through J10 to the Analytical Control Board for management.
The N.T.C. resistor detects the temperature of the pre-heater and is connected to J7 on Pins 5 and on Pins 3 and 4 (ground). These Pins are connected to the U2B amplifier, whose output via J2 Pin 25 carries information to the CPU board (Analytical Control Board) on input AN2 (P72) of the Micro R U2.
The pre-heater heating element is connected via J7 Pins 6 and 7 and is powered by Q1 which is controlled by P.W.M. generated by the Micro R of the CPU. Furthermore, it can be excluded by switching the LS1 relay through Q6, conditioned by the OFFPR signal generated by the CPU.

2.8.1 SAMPLING INTERFACE ASSY P/N 00192-01

- **INPUT:**

  - Vertical Home (J9)
  - External Arm Home (J10)
  - Internal Arm Home (J11)
  - Diluter Home (J13)
  - NTC + (J7 Pin 5)
  - LEAK (J12)
  - PDIL (coming from the CPU) (J2 Pin 14)

- **OUTPUT:**

  - Vertical Arm (J3)
  - Internal Arm (J4)
  - External Arm (J5)
  - Diluter (J6)
  - Diluter Pump (J8)
  - Pre-heater (J7)
  - LEAK (J2)

2.9 LEVEL SENSOR BOARD 1-2 P/N 30-0005-XX

The integrated U4 circuit generates a trigger signal for U3 where the sampling probe is connected on Pin 6 via C2.
The capacity variation, produced by the contact between the sampling probe and a liquid, determines a voltage variation on Pin 3 of U3, which ranges from a value close to zero to one which tends towards + 5 V.
This signal is then further processed by U2 and Q1 and is placed in output from the board on J2 Pin 1.

2.10 REACTION TRAY INTERFACE P/N 00193-01

This board controls various functions:
J2, J3, J4 and J5 are the input connectors for the opto sensors of the filters wheel, of the washing station, of the reaction plate and of the cuvette holders. This information is transferred to the Analytical Control Board (CPU) using the OS2, OS3, OS4 and OSB signals via J1.
The ALFD3 signal controls power supply to the series of the three emitting diodes contained in the opto sensors connected to J2, J3 and J4. ALFD1 functions in a like manner relative to the opto sensor connected to J5.
Liquid leakage signal enters on J7 and is processed by U1A, whose output (LEAKP) returns via J1 on the CPU.
Plate temperature is detected by the N.T.C. sensor connected to J8 and sent to the Micro P.
The cuvette holder solenoid is turned on by activating the BCU signal produced by a 'Darlington' controlled by the Micro P.
The PWMP signal, that controls the reaction plate heater, is also produced by the Micro P. Its power absorption is controlled via the P71 signal.
Furthermore, the board distributes, toward other modules, input and/or output signals managed by the CPU.
24V and 12.5V arrive to the board. The 5V (U5) used for the amplifiers and the negative voltage (U4) that is sent to both the Sample and Reference PRE-AMPL/ADC are produced here.

2.11 REACTION TRAY INTERFACE P/N 00193-01

❖ INPUT:

- Home Washing Station (J3)
- Home Filters Wheel (J2)
- Home Reaction Tray (J4)
- Home Cuvette Holder (J5)
- Reaction Tray Leak (J7)
- Reaction Tray Temperature Sensor (J8)
- (PWMP (PWM for the Heater) (J1)
- BCU (Activation of the Cuvette Holder Solenoid) (J1)
- OFFPL (Activation of the Lamp, Feedthrough (J1)

❖ OUTPUT:

- Cuvette Solenoid Holder (J6)
- Reaction Tray Heater (J10)
- ALFD3 (three light emitting diodes in series) (J1)
- OS3 (Washing Station Home Sensor) (J1)
- OS2 (Filters Wheel Home Sensor) (J1)
- OS4 (RTC Tray Home Sensor) (J1)
- OSB (Cuvette Holder Home Sensor) (J1)
- ALFD1 (Cuvette Holder Sensor Diode Control) (J1)
- P72 (Reaction Plate Temperature) (J1)
- LEAKP (Reaction Plate Leak) (J1)
- P71 (Reaction Tray Heater Power Control) (J1)
- V- (Voltage –12V for PRE-AMPL/ADC) (J1)
- PWRES (Heater Power) (J1)
- OFFPL (Lamp Activation) (J9)

2.12 REACTION CHAMBER MOTOR INTERFACE P/N 00341-00

This board distributes the motors signals - those of the: filters wheel (J2), washing station (J3), and reaction plate (J4), part of the Reaction Group Assy.
The connector J1 interfaces the Stepper Motors Driver Board (30-00188-01) which is managed by the Micro P of the CPU via connector J1. Signal distribution for the three motors is carried out via the three above cited connectors.

2.13 PRE-AMPL/ADC P/N 00107-00

The FD1 photodiode detects light energy arriving from the optics. The amplifier (U2) amplifies this signal and sends it to the A/D serial converter ADS 1250.
Both U1 and U4 produce the +5V; the former for the analogic segment and the latter for the digital segment. U5 generates the –5V and U6 the voltage reference VREF. Y1 is the oscillator connected to the U3 clock.
The G0 and G1 signals determine the U3 gain (1, 2, 4 or 8).
The Board interfaces with the Reaction Tray Interface Board (00193-01) via the JP1connector that sends the signals to the Micro P.

2.14 PHOTOMETER LAMP PWS P/N 30-0004-00

This board powers the 6V 10W halogen lamp.
The main device of this circuit is a type LT 1083CP U1 integrated stabilizer which, under normal operative conditions, is regulated, via the 1 Kohm P1 potentiometer, to 6V for the lamp.
When the system is in Stand-by, the lamp is not turned off. Instead, the voltage is lowered from 6V to 1.2V by the Micro P which acts on the Q1 transistor via the OFFPL signal. This is done in order to not over-stress the lamp by turning it on and off frequently.

2.15 SAMPLE RACKS IDENTIFICATION BOARD P/N 00446-00

This board checks that the samples racks are inserted correctly.
The sole power supply used in the board is Vcc (5V), derived from V_M (24V) that arrives to the board via the J1 connector.
Racks sensing is carried out via OPB848 type opto sensors U_1, U_2, U_3, U_4, and U_5. These sensors' outputs arrive to connector J7 of the Control Panel (30-00342-00) via J1. They exit through the same J1 and go towards J2 of the Stepper Motors Driver Board (30-00188-01) and from here, via J4 and J7 enter on J7 and J17 of the Analytical Control Board (CPU) (30-00195-01) for the management functions performed by the Micro P (U_1).

2.16 CONTROL PANEL P/N 00342-00

This board controls the levels of the Rinse, Water and Cleaning Solution bottles, the closure of the sample rack and reagent rack doors, the buttons – indicators placed on the front panel of the instrument – and the acoustic alarm buzzer.
The St-by and Ready buttons are only lit indicators. The STAT button, instead, actually turns off the acoustic alarms.
Signals regarding the presence of the five sample racks pass through this board.

2.17 HYDRAULICS INTERFACE BOARD P/N 00419-00

This board is used to distribute the following DARLINGTON commands:
EV1, EV3, EV4, EV5, EV6, MP2, MP3, MP4, INTERLOOK, or INTERLOCK.
In addition, this board is used to distribute the peristaltic pump's motor signals.
U2 generates +5 V , U1 is the operator that keeps the leak (D9 on = leak alarm) under control.
The parts connected to J9 and J10 are designed to monitor the fluctuating liquids of the peristaltic pump's two canals.
The microswitch signal transits to J8 which identifies if the cover is open (IL=1) or closed (IL=0).

CHAPTER 03

- INSTALLATION -

INDEX

3.1 UNPACKING 2

3.2 INSTALLATION 4

3.2.1 INSTALLATION SITE SPECIFICATIONS 4

3.2.2 ELECTRIC CURRENT REQUIREMENTS 4

3.2.3 CONNECTION of the ACCESSORIES 5

3.2.3.1 POWER SUPPLY 5

3.2.3.2 COMPUTER - INSTRUMENT CONNECTION 5

3.2.4 ATTENTION 6

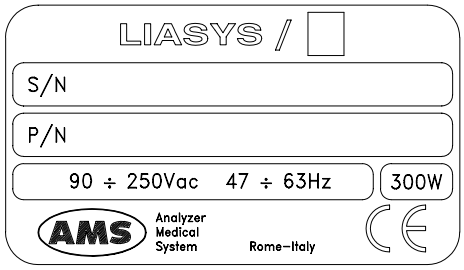
3.2.5 SYMBOLS 6

3.2.6 REGULATORY COMPLIANCE 6

3.1 UNPACKING

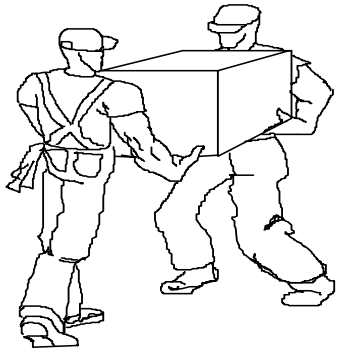
The ***LIASYS*** is packed and delivered in two separate wooden crates: one contains the analyzer itself and the other the computer, along with its accessories. In the event that the order not include the PC component, packing and delivery will involve one wooden crate plus a corrugated cardboard box. The packing has been expressly studied and designed to insure maximum protection of the contents during shipping and handling. It is therefore extremely important that the crate(s)/box be carefully examined upon delivery in order to ascertain their integrity. Special attention should be dedicated to examining the color of the "Shock Watch" glued to the crates, which must show the color 'white'. A 'red' "Shock Watch" indicates that the crate(s) have experienced some sort of 'shock' during handling, transport and/or delivery. This fact must be noted by the courier on the delivery note, as must any and all visible external damage (for example: holes, dents, rips or tears, water marks, etc.) evident at the moment of delivery. This will simplify matters in the event of any future claims for damages.

Upon arrival of the crate(s)/box, take out the delivery note and make sure that all the items on the packing list are included in the crates and are undamaged. Make sure the series number on the delivery note/packing list corresponds to that impressed on the plate on the right side of the instrument.



Open the crate(s)/box from the top and very carefully take out:

- the instrument;
- the computer and accessories.



MAKE SURE THAT THE UNPACKING IS CARRIED OUT BY TWO PEOPLE.

Do not discard the delivery crate(s)/box or the packing material until the correct functioning of the instrument has been ascertained.
Remove all the items from the crate(s)/box very carefully.
Remove the adhesive tape from the cover of the samples and reagents housing, from the front panels and from the samples and reagents racks.
Before connecting the *"Liasys"*, remove the protective packing material placed under the sampling arm and under the wash station group.

Warning: in the event that it is necessary to repack any or all of the delivered item(s), the following procedures must be carefully followed:

- Reposition the protective packing material under the sampling arm and under the wash station group.

- Tape down (using masking tape if possible) the cover of the samples and reagents housing, the front panels, and the samples and reagents racks.

- Remove the probe from the sampling arm and place it inside a cuvette. Then cap the cuvette and tape the cap down.

- Be very careful to not bend the wash station cannulas when repositioning the protective packing material.

- Fill the empty spaces around the accessories packed in the crate using *"pluriballs"* or other suitable packing material.

3.2 INSTALLATION

The LIASYS must only be installed by a qualified technician who has been authorised and trained to do so. During its installation the system will be checked once again to ensure correct functioning. The persons who are required to operate the LIASYS system must have received the adequate training. This should also include the "know-how" of the normal maintenance for the instrument. A description of the maintenance will be found in Chapter 7 of this manual.

LIASYS is a complex system, and it is therefore extremely important that it is correctly installed in order to fully guarantee fine performance. If the installation and use directions, given in this manual, are not correctly followed and/or security indications are not respected, AMS cannot guarantee correct functioning of the instrument. Apart from this, the security of the operator could be placed at risk.

3.2.1 INSTALLATION SITE SPECIFICATIONS

Ascertain that the LIASYS system is not exposed to direct sunlight, draughts, dust or strong magnetic fields. In addition, please take note of the following conditions required for the location of the installation:

USE	In covered and dry place
DEGREE OF POLLUTION	2
INSULATION CLASS	I
INSTALLATION CATEGORY	II
TEMPERATURE	between18°-32°C
HUMIDITY	20% ÷ 85%
ALTITUDE	Max 3000 m
LOCATION	Shelf or table with a minimum surface of 110x70 cm stable and free of vibration
VENTILATION	Leave a minimum distance of 10 cm around the instrument to permit air circulation . Make sure that the fan (situated under the reagent compartment) is not blocked by any object

3.2.2 ELECTRIC CURRENT REQUIREMENTS

The power voltages to which the instrument is adapted are indicated on the left-hand side (see fig. 1). It must be plugged into a plug of the correct voltage.

VOLTAGE	90 ÷ 250 Vac 47/63 Hz ± 10%
FUSES	6.3 Amp/T - 6.3 x 32

NOTE: IT IS ADVISABLE TO MAINTAIN THE MAXIMUM STABILITY OF THE ELECTRICAL CURRENT IN THE LABORATORY. WHERE THIS IS NOT POSSIBLE OR ASCERTAINABLE, USE OF THE FOLLOWING SUPPLEMENTARY DEVICES IS RECOMMENDED:

ELECTRONIC STABILIZER

Used to stabilise the electric voltage in the laboratory. Any stabiliser with a power potential greater than 0.5 KW, currently available on the market, can be used.

NO-BREAK MODULE UPS - (Uninterrupted Power Supply)

This module provides two important functions:

- stabilises the main-line power
- supplies current to the instrument in case of a main-line power failure.

3.2.3 CONNECTION OF THE ACCESSORIES

3.2.3.1 POWER SUPPLY

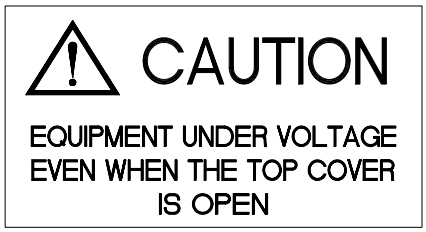
Fig. 1 Plug (use the feeder cable supplied with the instrument).
The sticker indicates the power supply voltage and the values of the fuses.

3.2.3.2 COMPUTER - INSTRUMENT CONNECTION

The instrument and the Personal Computer are connected by one serial RS232 standard cable (Cod. 9-35 0055.01), which provides the hardware support for the communication

3.2.4 ATTENTION

The following label is found at the rear of the instrument.



NOTE: THE REAR PANELS OF THE INSTRUMENT MUST NEVER BE OPENED WITHOUT HAVING FIRST SWITCHED THE INSTRUMENT OFF AND DISCONNECTED THE ELECTRICITY CABLE.

THE MAINTENANCE AND CLEANING PROCEDURES FOUND IN CHAPTER 07 OF THIS MANUAL MUST BE RESPECTED AT ALL TIMES. REMEMBER TO FOLLOW THE DECONTAMINATION PROCEDURE IN CASE OF INSTRUMENT REMOVAL (SEE CHAPTER 07) .

3.2.5 SYMBOLS

ATTENTION: READ THE INSTRUCTIONS IN THE USER MANUAL

TERMINAL OF TOTAL MASS PROTECTION (CONDUCTOR)

3.2.6 REGULATORY COMPLIANCE

The LIASYS instrument complies with:

Safety :

- EN 61010 - 1 : 1993 + A2 : 1995 therefore meeting the essential requirements of L.V.D. 73/23/EEC and 93/68/EEC

EMC :

- EN 61326-1 therefore meeting the essential requirements of Electromagnetic Compatibility Directive 89/336/EEC - 92/31/EEC

CHAPTER 04

- ELECTRICAL SCHEMES AND DRAWINGS -

INDEX

INTERCONNECTION DIAGRAM LIASYS [SB] 16-00457-XX
LIASYS NEW [MA] 16-00457-00

COMPLETE ARM ASSY 9-MA-15-0021-02

DILUTER ASSY 9-MA-15-0007-03

REACTION CHAMBER ASSY 9-MA-15-0008-01

WASHING STATION PUMPS [MA] 15-00406-00

ELECTRONIC CONTROLLER ASSY [MA] 10-00202-01

SCHEMATIC POWER SUPPLY 9-SE-15-0014-01

ANALYTICAL CONTROL BOARD [MA] 30-00195-01
ANALYTICAL CONTROL BOARD [SE] 00195-01

STEPPER MOTORS DRIVER BOARD [MA] 30-00188-01
STEPPER MOTORS DRIVER BOARD [SE] 00188-01

SAMPLING INTERFACE ASSY [MA] 00192-01
SAMPLING INTERFACE ASSY [30] 00192-01

REACTION TRAY INTERFACE [MA] 00193-01
REACTION TRAY INTERFACE [30] 00193-01

REACTION CHAMBER MOTOR INTERFACE [MA] 00341-00
REACTION CHAMBER MOTOR INTERFACE [30] 00341-00

PRE-AMPL/ADC [MA] 30-00107-XX
PRE-AMPL ADC [MA] 00107-00

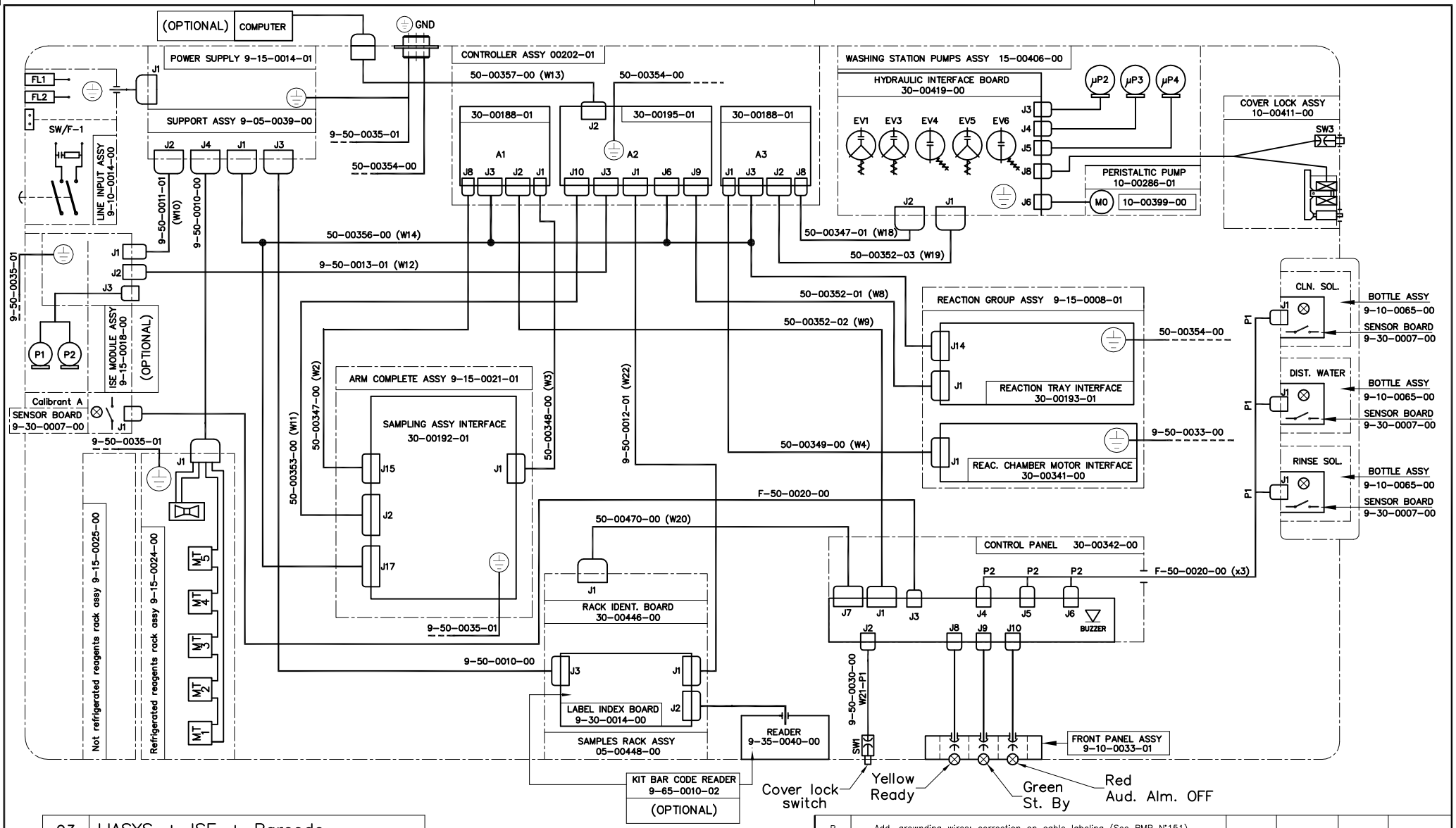
PHOTOMETER LAMP PWS 9-[MA]-30-0004-00
LAMP PWS BOARD 9-ME-30-0004-00

SAMPLE RACKS IDENTIFICATION BOARD [MA] 30-00446-00
SAMPLE RACKS IDENTIFICATION BOARD [MA] 00446-00

CONTROL PANEL [MA] 00342-00
CONTROL PANEL [30] 00342-00

HYDRAULICS INTERFACE BOARD [30] 00419-00
HYDRAULICS INTERFACE BOARD [SE] 00419-00

ALIMENTATION CABLE [MA] 50-00356-00



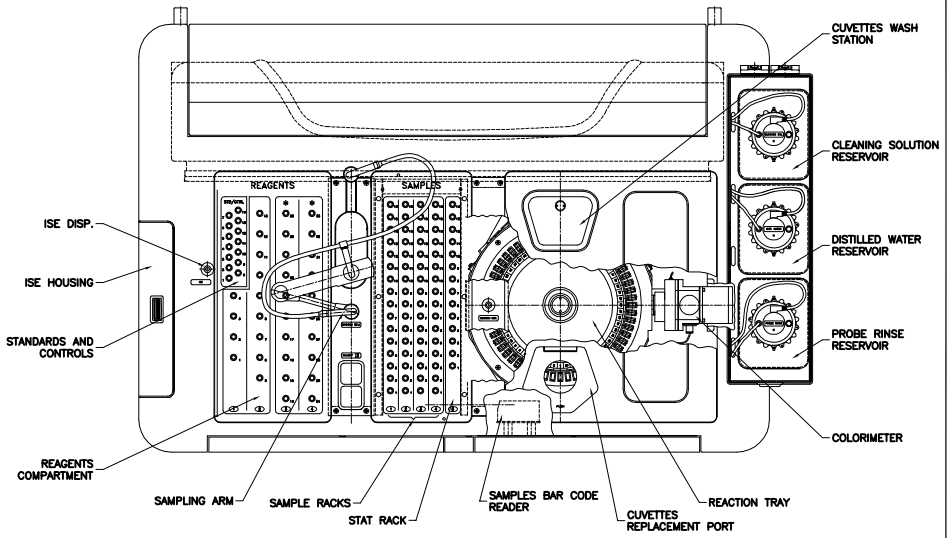
03	LIASYS + ISE + Barcode
02	LIASYS + Barcode reader
01	LIASYS + ISE module
00	LIASYS
Sol.	Description

Rev.	Description				
B	Add. grownding wires; correction on cable labeling (See RMP N°151)				
A	Added reagents rack assy and optional (See RMP N°129)	L.M.	01.07.2002	A.G.	01.07.2002
Rev.	Description	Checked	Date	Approved	Date

The present drawing is property of AMS, any use without authorization will be prosecuted accordingly to the law.

AMS Analyzer Medical System
Via Forlanini s.n.c. (Via Tiburtina km. 18,300) 00012 Guidonia (Roma)

Description: INTERCONNECTION DIAGRAM — LIASYS	Scale: 1:1	Sheet: 1 of 1	Drawn: G.Pucci	Date: 16.09.2002	
			Checked: L.Mancini	Date: 16.09.2002	
	Car.: [SB]	Drawing: 16-00457-XX	Rev.: B	Approved: A.Gagliarducci	Date: 16.09.2002



Rev.	Description	Checked	Date	Approved	Date
0	Emission				

AMS Analyzer Medical System — Via Fortebbi s.n.c. (Via Tiburtina km. 18,300) 00012 Guidonia (Roma)

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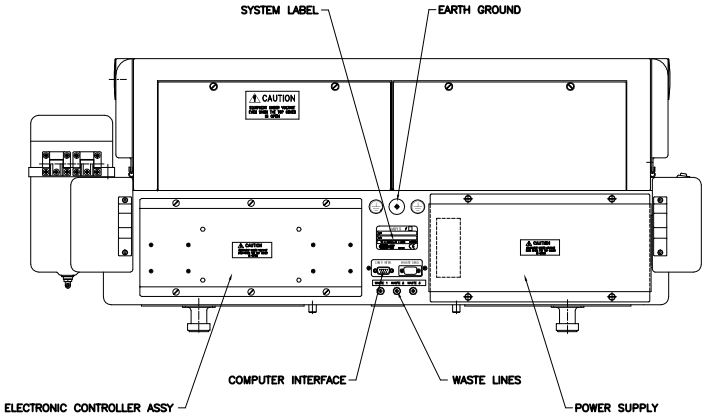
Drawn	G.Pucci	Date	07.02.2002
Checked	L.Mancini	Date	07.02.2002
Approved	A.Gagliarducci	Date	07.02.2002

Description: LIASYS NEW (TOP VIEW) — Scale 1:4 — Sheet 1 of 1 — Cur. [MA] — Drawing 16-00457-00 — Rev. 0



Rev.	Description	Checked	Date	Approved	Date
0	Emission				

AMS Analyzer Medical System — Via Fortebbi s.n.c. (Via Tiburtina km. 18,300) 00012 Guidonia (Roma)

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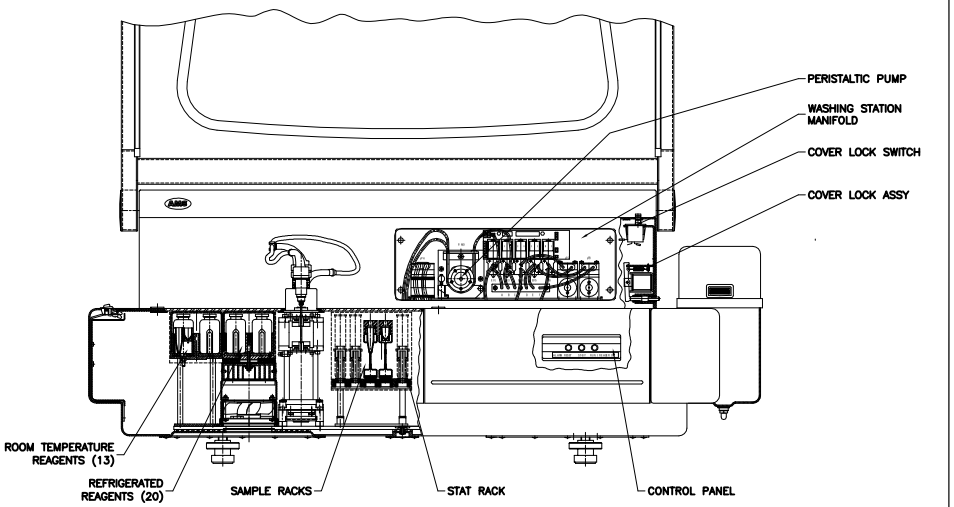
Drawn	G.Pucci	Date	07.02.2002
Checked	L.Mancini	Date	07.02.2002
Approved	A.Gagliarducci	Date	07.02.2002

Description: LIASYS NEW (REAR VIEW) — Scale 1:4 — Sheet 1 of 1 — Cur. [MA] — Drawing 16-00457-00 — Rev. 0



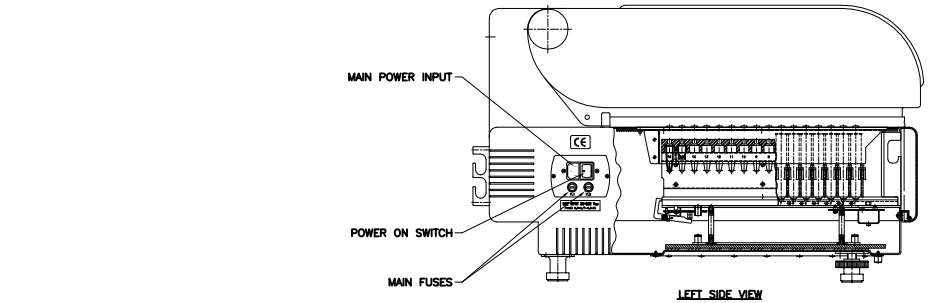
Rev.	Description	Checked	Date	Approved	Date
0	Emission				

AMS Analyzer Medical System — Via Fortebbi s.n.c. (Via Tiburtina km. 18,300) 00012 Guidonia (Roma)

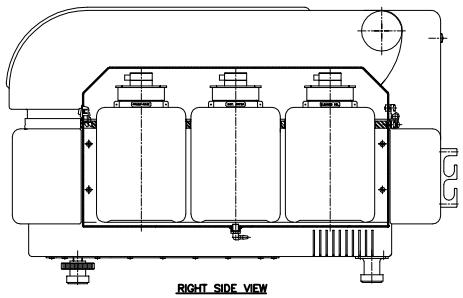
The present drawing is property of AMS, any use without authorization will be prosecuted accordingly to the law.

Drawn	G.Pucci	Date	07.02.2002
Checked	L.Mancini	Date	07.02.2002
Approved	A.Gagliarducci	Date	07.02.2002

Description: LIASYS NEW (FRONT VIEW) — Scale 1:4 — Sheet 1 of 1 — Cur. [MA] — Drawing 16-00457-00 — Rev. 0



LEFT SIDE VIEW



RIGHT SIDE VIEW

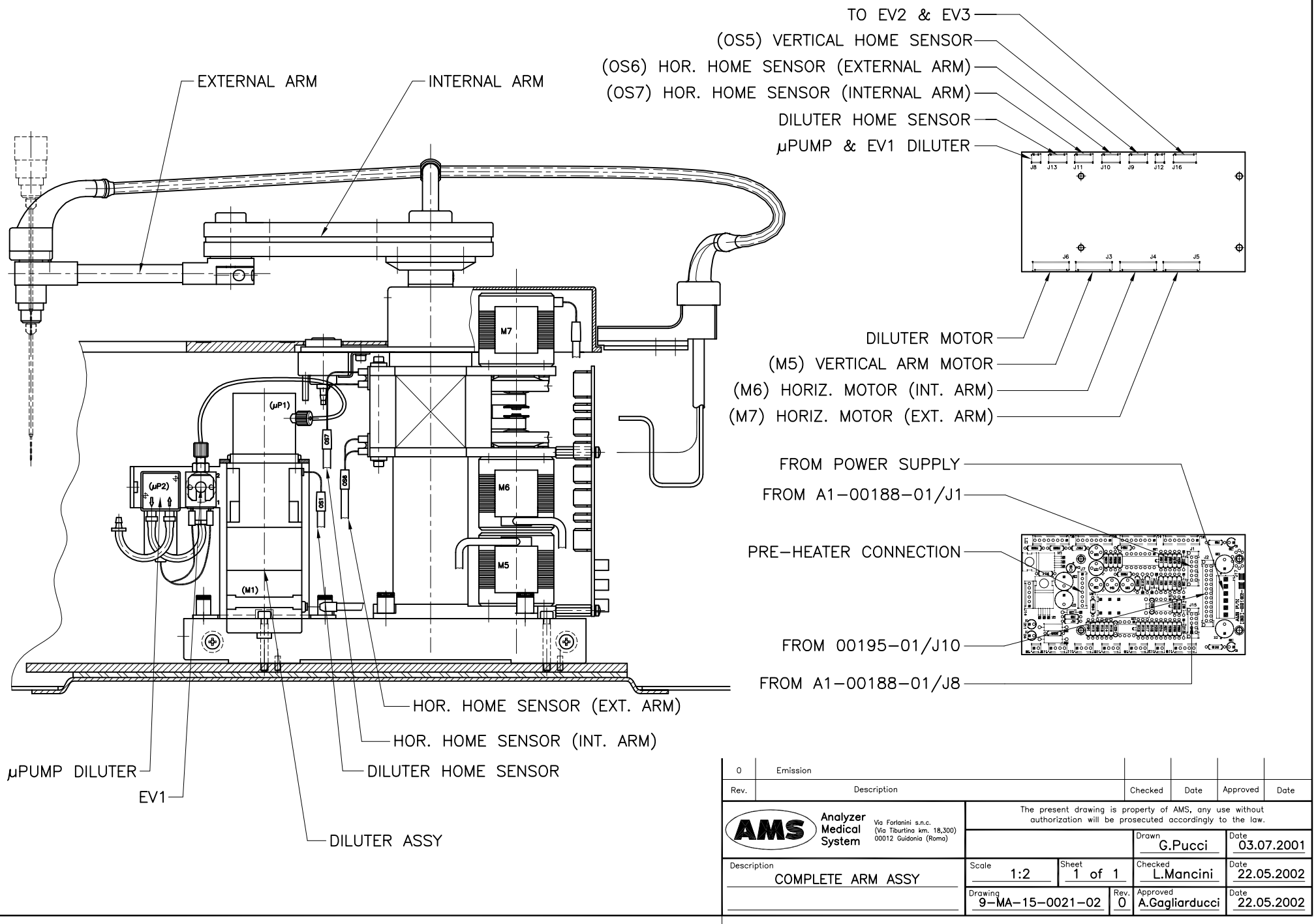
Rev.	Description	Checked	Date	Approved	Date
0	Emission				

AMS Analyzer Medical System — Via Fortebbi s.n.c. (Via Tiburtina km. 18,300) 00012 Guidonia (Roma)

The present drawing is property of AMS, any use without authorization will be prosecuted accordingly to the law.

Drawn	G.Pucci	Date	07.02.2002
Checked	L.Mancini	Date	07.02.2002
Approved	A.Gagliarducci	Date	07.02.2002

Description: LIASYS NEW — Scale 1:4 — Sheet 1 of 1 — Cur. [MA] — Drawing 16-00457-00 — Rev. 0



Rev.	Description	Checked	Date	Approved	Date
0	Emission				

AMS Analyzer Medical System
Via Forlanini s.n.c.
(Via Tiburtina km. 18,300)
00012 Guidonia (Roma)

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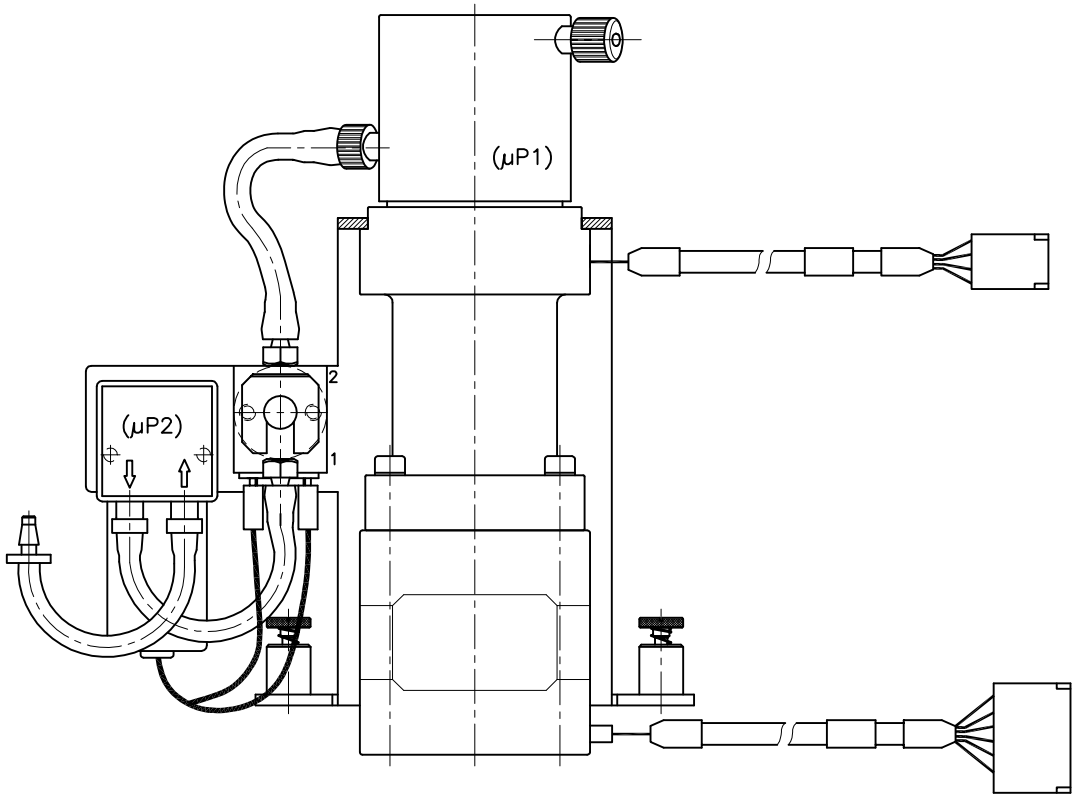
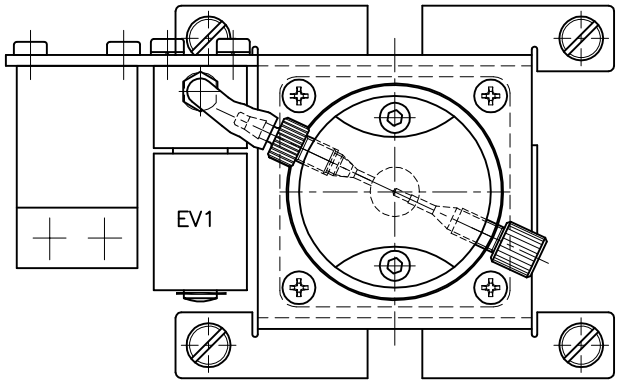
Drawn: G.Pucci			Date: 03.07.2001
Description: COMPLETE ARM ASSY	Scale: 1:2	Sheet: 1 of 1	Checked: L.Mancini — Date: 22.05.2002
	Drawing: 9–MA–15–0021–02	Rev.: 0	Approved: A.Gagliarducci — Date: 22.05.2002





Rev.	Description	Checked	Date	Approved	Date
0	Emission				

AMS Analyzer Medical System
Via Forlanini s.n.c.
(Via Tiburtina km. 18,300)
00012 Guidonia (Roma)

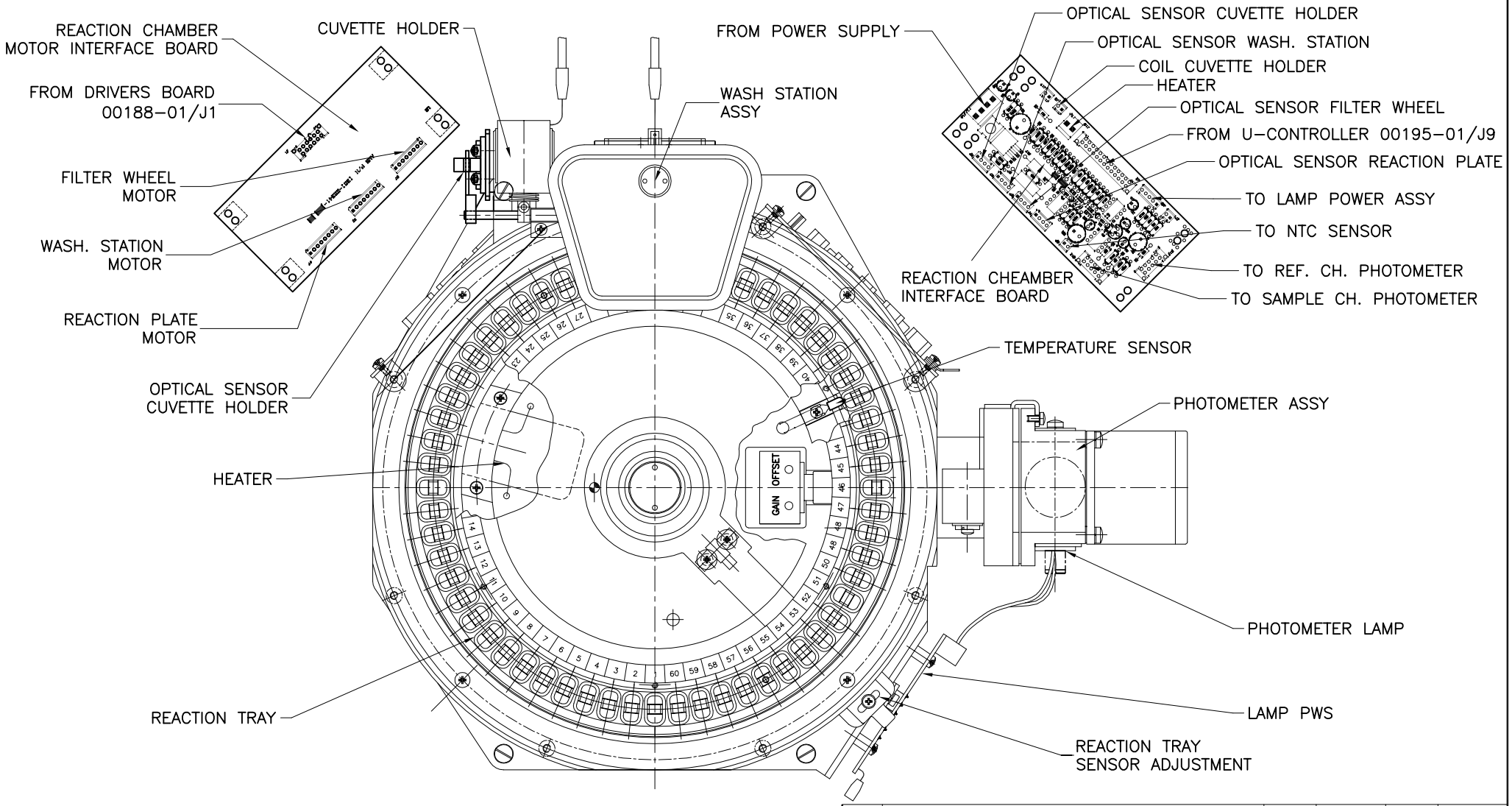
The present drawing is property of AMS, any use without authorization will be prosecuted accordingly to the law.

Description: DILUTER ASSY

Drawn: G.Pucci — Date: 14.04.2003

Scale: 1:2 — Sheet: 1 of 1 — Checked: L.Mancini — Date: 14.04.2003

Drawing: 9-MA-15-0007-03 — Rev.: 0 — Approved: A.G. — Date: 14.04.2003



Rev.	Description	Checked	Date	Approved	Date
B	Come da richiesta di modifica N°178 (mod. Rif. 1)				
A	Come da richiesta di modifica N°129 (mod. Rif. 1; sost. Rif. 9)	L.M.	19.07.2002	A.G.	19.07.2002
0	Emission (Come da richiesta di modifica N°89 mod. Rif. 1,2 e 9)	A.G.	28.05.2001	A.G.	28.05.2001

AMS Analyzer Medical System
Via Forlanini s.n.c.
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00012 Guidonia (Roma)

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Description: REACTION CHAMBER ASSY

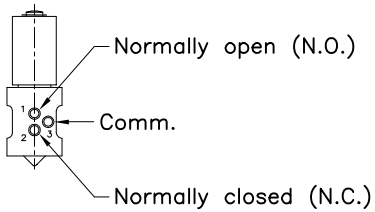
Drawn: G.Pucci — Date: 11.04.2001

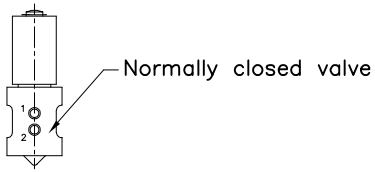
Scale: 1:2 — Sheet: 1 of 1

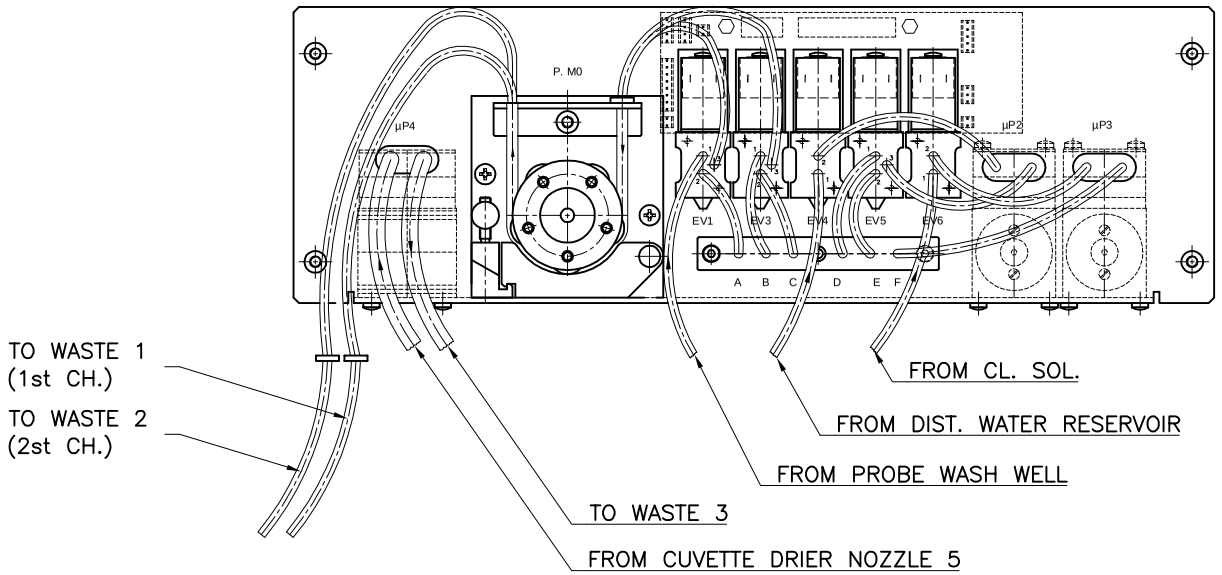
Checked: L.Mancini — Date: 06.06.2003

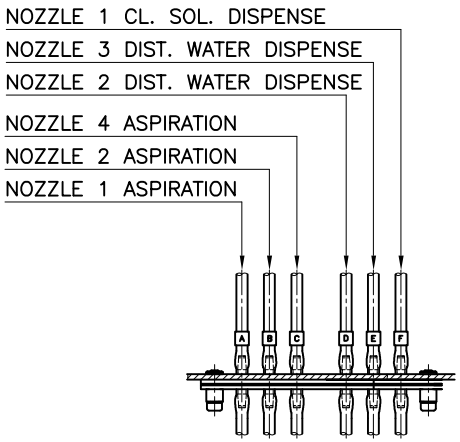
Drawing: 9-MA-15-0008-01 — Rev.: B

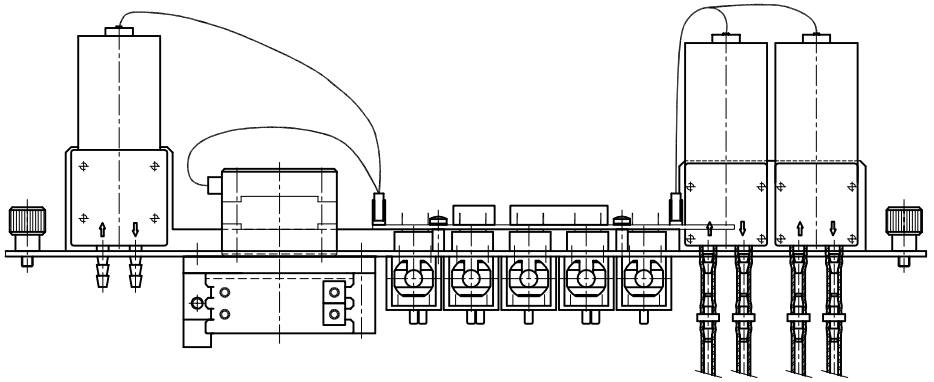
Approved: A.Gagliarducci — Date: 11.06.2003








NOZZLE 1 CL. SOL. DISPENSE
NOZZLE 3 DIST. WATER DISPENSE
NOZZLE 2 DIST. WATER DISPENSE
NOZZLE 4 ASPIRATION
NOZZLE 2 ASPIRATION
NOZZLE 1 ASPIRATION
A B C D E F



Rev.	Description	Checked	Date	Approved	Date
0	Emission				

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AMS Analyzer Medical System
Via Forlanini s.n.c.
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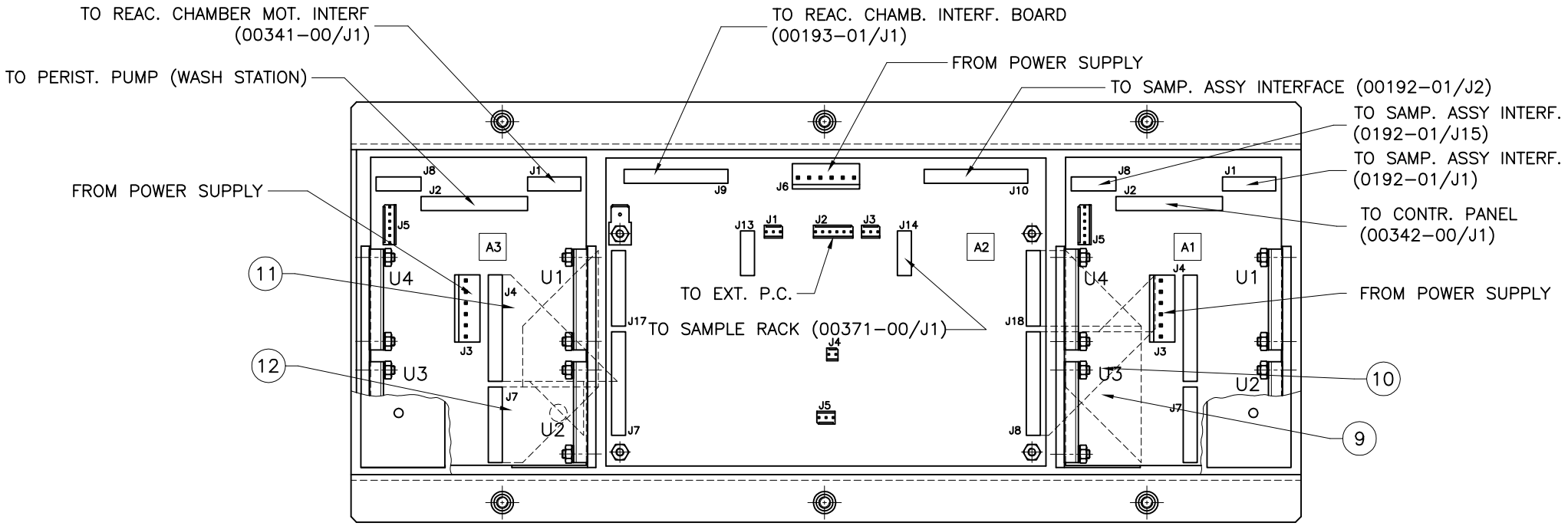
00012 Guidonia (Roma)

Description: WASHING STATION PUMPS

Drawn	Date
G.Pucci	20.11.2001

Scale	Sheet	Checked	Date
	1 of 1	A.Gagliarducci	20.11.2001

Car.	Drawing	Rev.	Approved	Date
[MA]	15–00406–00	0	A.Gagliarducci	20.11.2001



U1	FILTER WHEEL MOT.
U2	WASH STAT. MOT.
U3	REACTION PLATE MOT.
U4	PERISTALTIC PUMP.

U1	HOR. MOT. (EXT. ARM)
U2	HOR. MOT. (INT. ARM)
U3	VERTICAL MOT. (ARM)
U4	DILUTER MOTOR

CONNECTION			
from	to	P/N wire	Ref.
J7-A1	J18-A2	50-00351-00	9
J4-A1	J8-A2	50-00365-00	10
J4-A3	J7-A2	50-00352-00	11
J7-A3	J17-A2	50-00350-00	12

Rev.	Description	Checked	Date	Approved	Date
0	Emission (Come da richiesta di modifica N°95)				

Material

Treatment

Finish

AMS Analyzer Medical System
Via Forlanini s.n.c. (Via Tiburtina km. 18,300) 00012 Guidonia (Roma)

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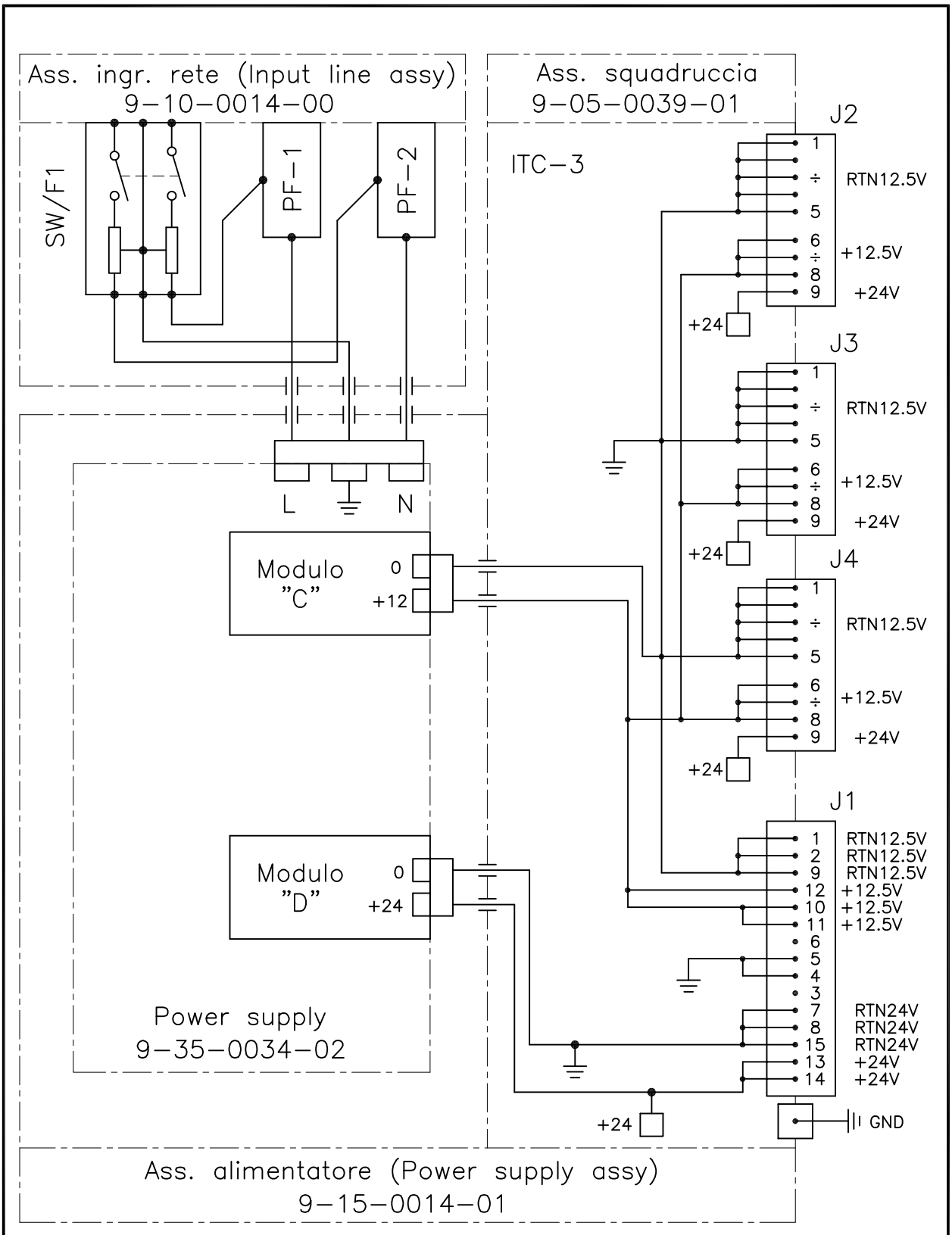
Description: ELECTRONIC CONTROLLER ASSY

Drawn	A.Nicoletti
Date	12.12.2001
Checked	A.G.
Date	12.12.2001
Approved	A.G.
Date	12.12.2001
Scale	1:1.5
Sheet	1 of 1
Car.	[MA]
Drawing	10-00202-01
Rev.	0



Rev.	Description	Checked	Date	Approved	Date
0	Emission				

AMS Analyzer Medical System
Via Forlanini s.n.c.
(Via Tiburtina km. 18,300)
00012 Guidonia (Roma)

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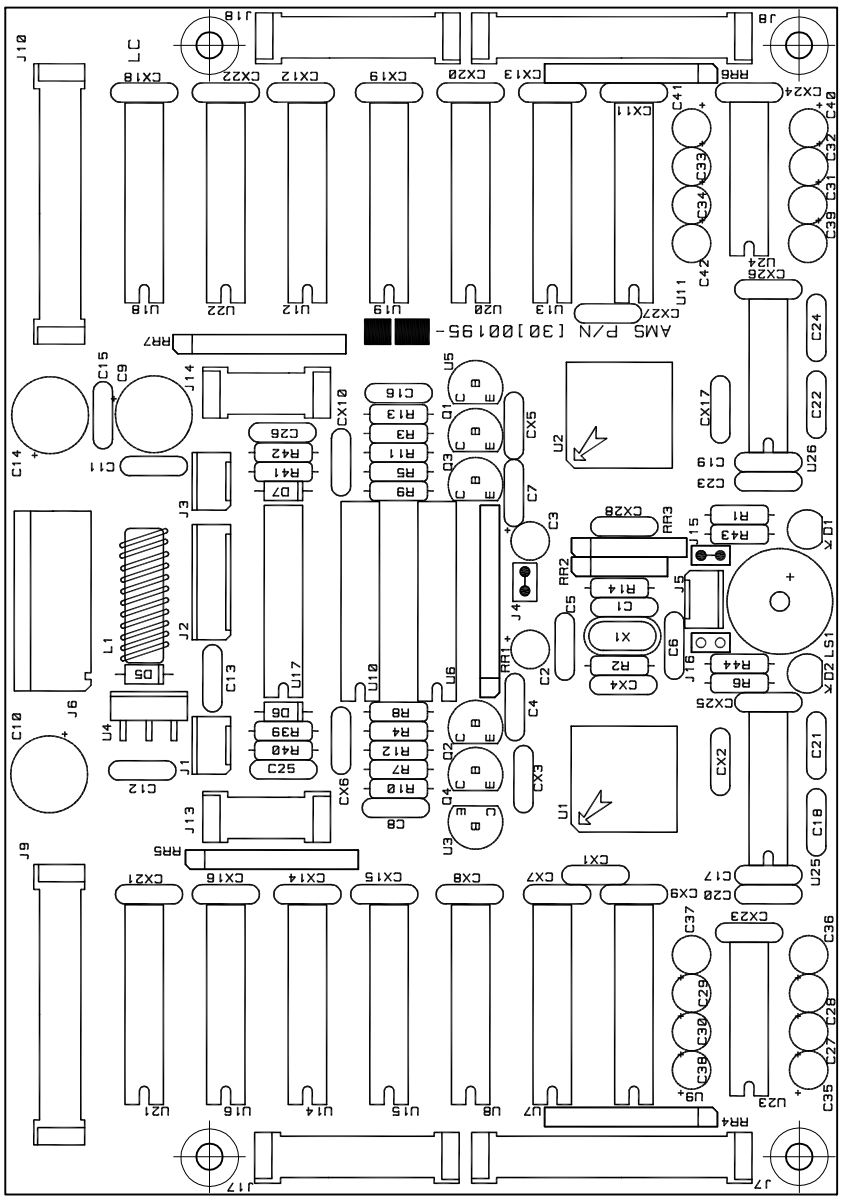
			Drawn G.Pucci	Date 08.01.2002
Description SCHEMA ELETTRICO ALIMEN. / SCHEMATIC POWER SUPPLY	Scale	Sheet 1 of 1	Checked R.Cornacchia	Date 08.01.2002
	Drawing 9-SE-15-0014-01	Rev. 0	Approved A.Gagliarducci	Date 08.01.2002



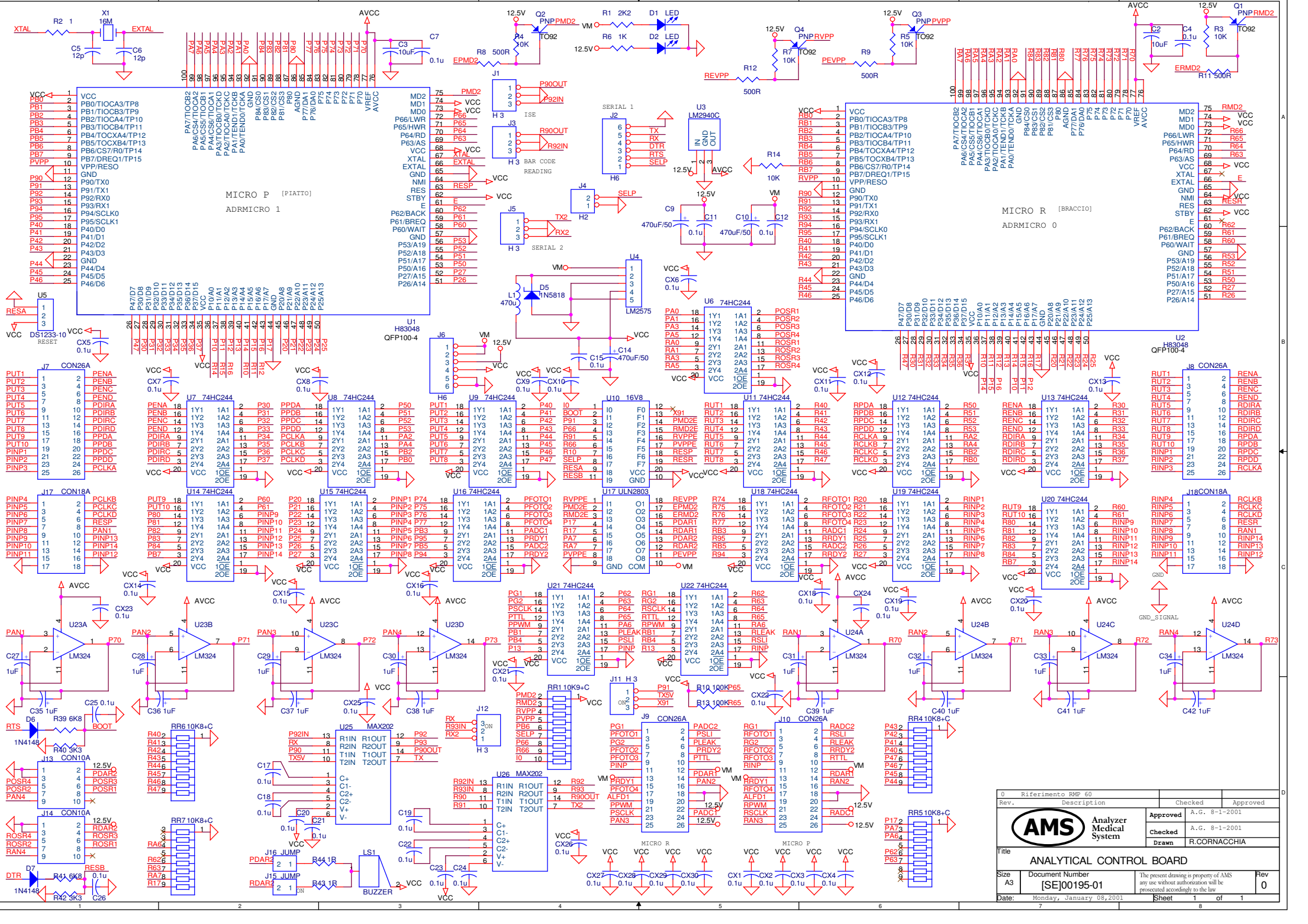
NOTA :—Sul J4 è disponibile il relativo jumper.

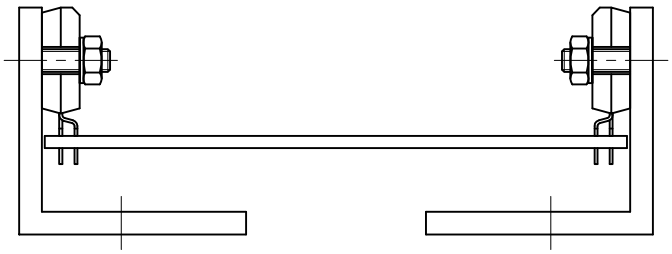
Rev.	Description	Checked	Date	Approved	Date
0	Emission				

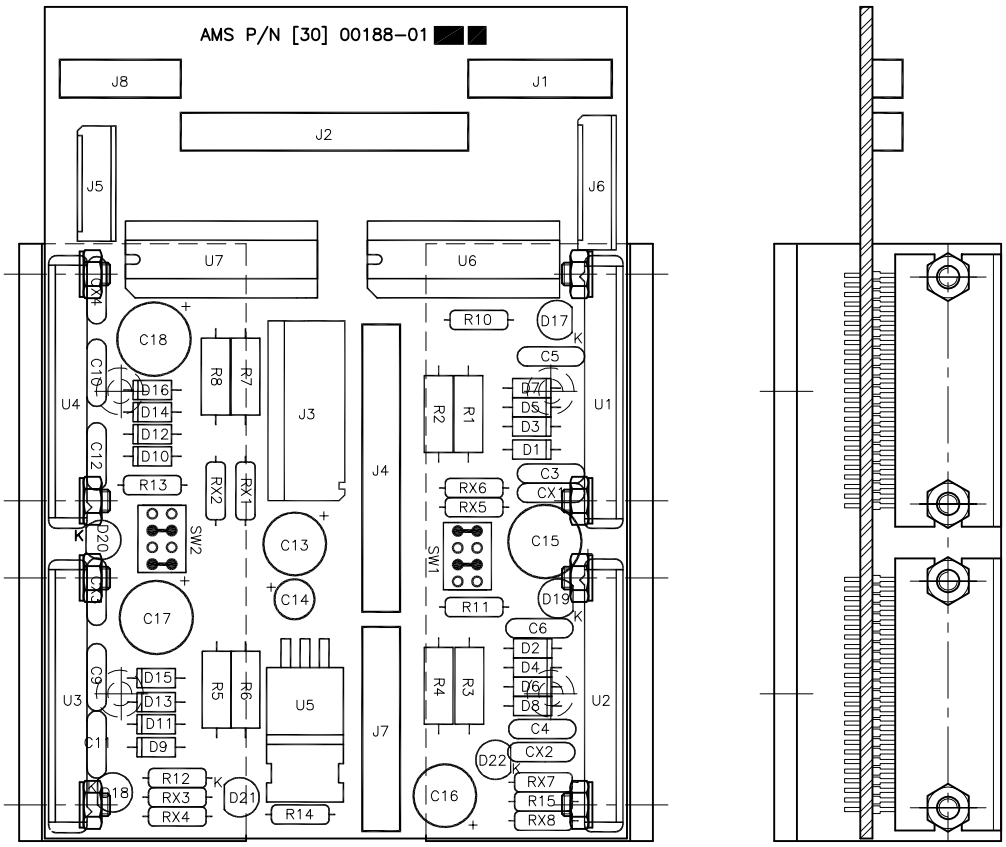
AMS Analyzer Medical System
Via Forlanini s.n.c.
(Via Tiburtina km. 18,300)
00012 Guidonia (Roma)

The present drawing is property of AMS, any use without authorization will be prosecuted accordingly to the law.

Description	Scale	Sheet	Drawn	Date
Analytical Control Board		1 of 1	A.Nicoletti	04—10—00
			Checked R.Cornacchia	04—10—00
	Car. [MA] / Drawing 30—00195—01 / Rev. 0		Approved A.Gagliarducci	04—10—00


MICRO P [PIATTO]
ADRMICRO 1
MICRO R [BRACCIO]
ADRMICRO 0
H83048
QFP100-4
LM2575
LM2940C
LM324
MAX202
74HC244
ULN2803
16V8
CON26A
CON18A
CON10A
DS1233-10
1N5818
1N4148
BUZZER
SERIAL 1
SERIAL 2
BAR CODE READING
ISE
RESET
Riferimento RMP 60
Description
Checked
Approved
Analyzer Medical System
Approved A.G. 8-1-2001
Checked A.G. 8-1-2001
Drawn R.CORNACCHIA
ANALYTICAL CONTROL BOARD
Document Number [SE]00195-01
Rev 0
Date: Monday, January 08,2001
Sheet 1 of 1





Rev.	Description	Checked	Date	Approved	Date
B	Come da richiesta di modifica N°162				
A	Come da richiesta di modifica N°152 (aggiunte basette dissipatrici)	L.M.	10.10.2002	A.G	10.10.2002
0	Emission (Come da richiesta di modifica N°95)	A.N.	06.08.2001	A.G	06.08.2001

AMS Analyzer Medical System
Via E.Barsanti 17/A
(Via Tiburtina km. 18,300)
00012 Guidonia (Roma)

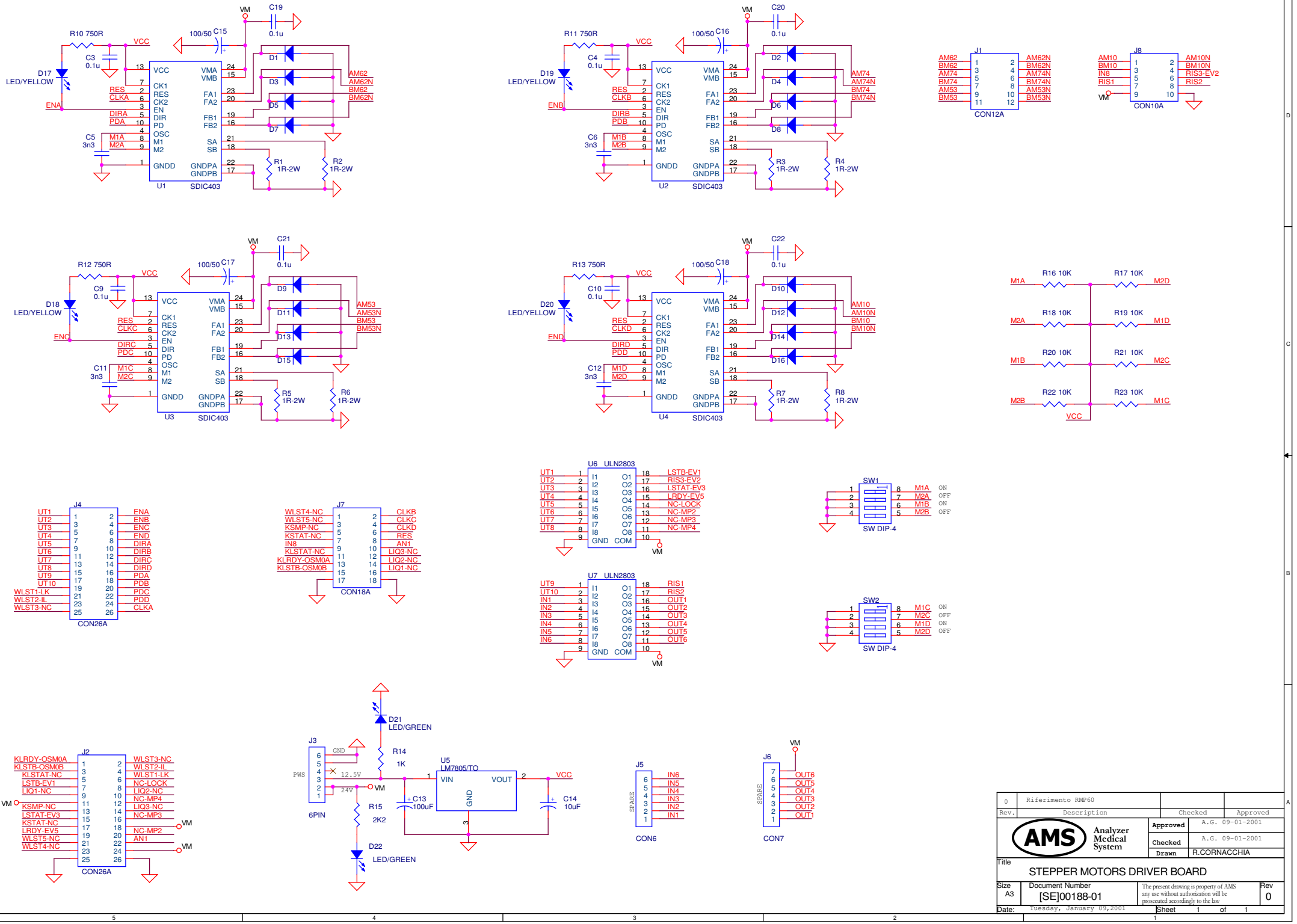
The present drawing is property of AMS, any use without authorization will be prosecuted accordingly to the law.

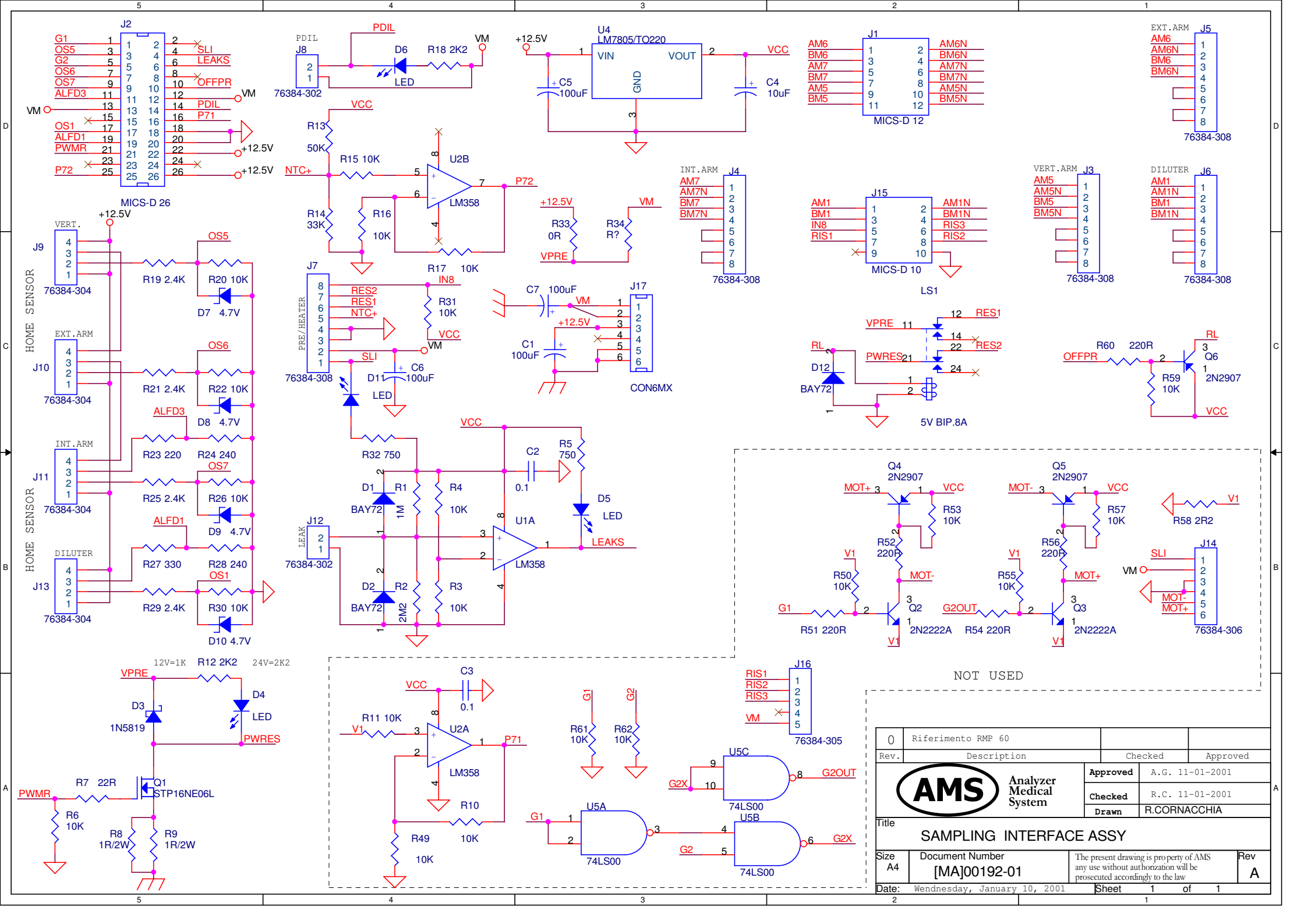
Description: STEPPER MOTORS DRIVER BOARD

Drawn	Date
G.Pucci	07.05.2003

Scale	Sheet	Checked	Date
1:1	1 of 1	L.Massenzi	07.05.2003

Car.	Drawing	Rev.	Approved	Date
[MA]	30-00188-01	B	A.Gagliarducci	07.05.2003


R10 750R
VCC
C3 0.1u
D17 LED/YELLOW
ENA
100/50 C15
VM
C19 0.1u
D1
D3
D5
D7
AM62
AM62N
BM62
BM62N
C5 3n3
M1A
M2A
DIRA
PDA
R1 1R-2W
R2 1R-2W
U1 SDIC403
R11 750R
C4 0.1u
D19 LED/YELLOW
ENB
100/50 C16
C20 0.1u
D2
D4
D6
D8
AM74
AM74N
BM74
BM74N
C6 3n3
M1B
M2B
DIRB
PDB
R3 1R-2W
R4 1R-2W
U2 SDIC403
J1
AM62
BM62
AM74
BM74
AM53
BM53
AM62N
BM62N
AM74N
BM74N
AM53N
BM53N
CON12A
J8
AM10
BM10
IN8
RIS1
AM10N
BM10N
RIS3-EV2
RIS2
CON10A
R12 750R
C9 0.1u
D18 LED/YELLOW
ENC
100/50 C17
C21 0.1u
D9
D11
D13
D15
AM53
AM53N
BM53
BM53N
C11 3n3
M1C
M2C
DIRC
PDC
R5 1R-2W
R6 1R-2W
U3 SDIC403
R13 750R
C10 0.1u
D20 LED/YELLOW
END
100/50 C18
C22 0.1u
D10
D12
D14
D16
AM10
AM10N
BM10
BM10N
C12 3n3
M1D
M2D
DIRD
PDD
R7 1R-2W
R8 1R-2W
U4 SDIC403
R16 10K
R17 10K
R18 10K
R19 10K
R20 10K
R21 10K
R22 10K
R23 10K
M1A
M2D
M2A
M1D
M1B
M2C
M2B
M1C
VCC
J4
UT1
UT2
UT3
UT4
UT5
UT6
UT7
UT8
UT9
UT10
WLST1-LK
WLST2-IL
WLST3-NC
ENA
ENB
ENC
END
DIRA
DIRB
DIRC
DIRD
PDA
PDB
PDC
PDD
CLKA
CON26A
J7
WLST4-NC
WLST5-NC
KSMP-NC
KSTAT-NC
IN8
KLSTAT-NC
KLRDY-OSM0A
KLSTB-OSM0B
CLKB
CLKC
CLKD
RES
AN1
LIQ3-NC
LIQ2-NC
LIQ1-NC
CON18A
U6 ULN2803
U7 ULN2803
LSTB-EV1
RIS3-EV2
LSTAT-EV3
LRDY-EV5
NC-LOCK
NC-MP2
NC-MP3
NC-MP4
RIS1
RIS2
OUT1
OUT2
OUT3
OUT4
OUT5
OUT6
SW1
SW2
SW DIP-4
ON
OFF
J2
KLRDY-OSM0A
KLSTB-OSM0B
KLSTAT-NC
LSTB-EV1
LIQ1-NC
KSMP-NC
LSTAT-EV3
KSTAT-NC
LRDY-EV5
WLST5-NC
WLST4-NC
WLST2-IL
WLST1-LK
NC-LOCK
LIQ2-NC
NC-MP4
LIQ3-NC
NC-MP3
NC-MP2
AN1
CON26A
J3
PWS
GND
12.5V
24V
6PIN
D21 LED/GREEN
R14 1K
R15 2K2
D22 LED/GREEN
U5 LM7805/TO
VIN
VOUT
C13 100uF
C14 10uF
VCC
J5
SPARE
CON6
J6
CON7
0
Riferimento RMP60
Rev.
Description
Checked
Approved
AMS
Analyzer Medical System
Approved
A.G. 09-01-2001
Checked
A.G. 09-01-2001
Drawn
R.CORNACCHIA
Title
STEPPER MOTORS DRIVER BOARD
Size
A3
Document Number
[SE]00188-01
The present drawing is property of AMS any use without authorization will be prosecuted accordingly to the law
Rev
0
Date:
Tuesday, January 09,2001
Sheet
1
of
1



Rev.	Description	Checked	Approved
0	Riferimento RMP 60		

AMS Analyzer Medical System

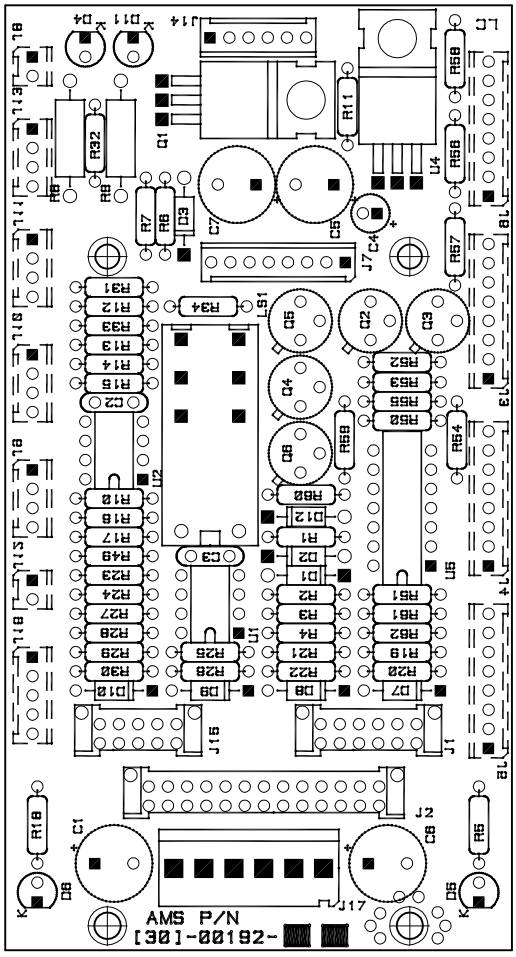
Approved	A.G. 11-01-2001
Checked	R.C. 11-01-2001
Drawn	R.CORNACCHIA

Title: SAMPLING INTERFACE ASSY

Size	Document Number	Rev
A4	[MA]00192-01	A

The present drawing is property of AMS any use without authorization will be prosecuted accordingly to the law

Date: Wednesday, January 10, 2001 Sheet 1 of 1



Rev.	Description	Checked	Date	Approved	Date
0	Emission				

Analyzer Medical System
Via Forlanini s.n.c.
(Via Tiburtina km. 18,300)
00012 Guidonia (Roma)

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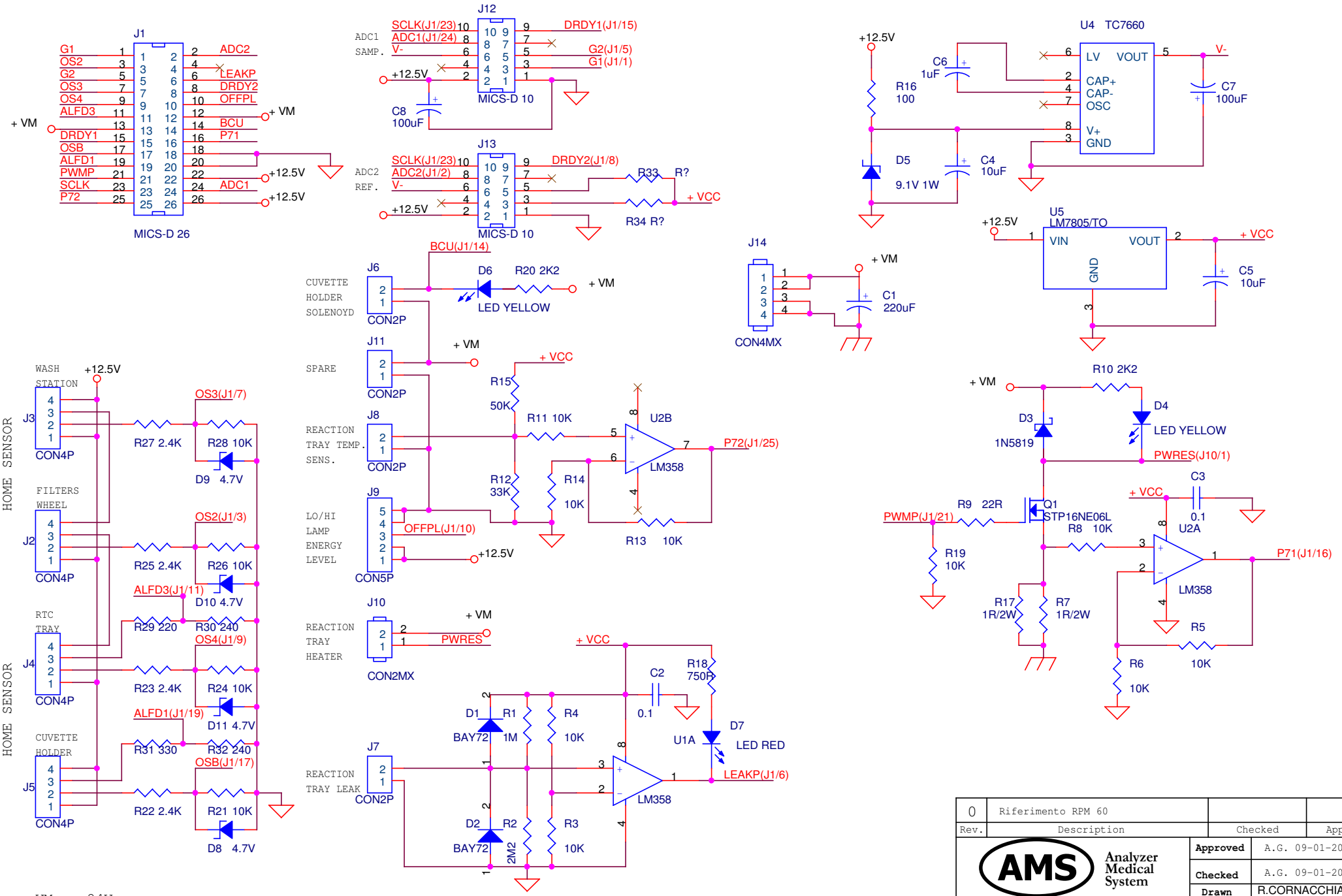
Description: SAMPLING INTERFACE ASSY	Scale:	Sheet: 1 of 1		Drawn: A.Nicoletti		Date: 01.06.2001	
				Checked: R.Cornacchia		Date: 01.06.2001	
	Car.: [30]	Drawing: 00192-01	Rev.: 0	Approved: A.Gagliarducci		Date: 01.06.2001	



Rev.	Description	Checked	Approved
0	Riferimento RPM 60		

AMS Analyzer Medical System

Approved	A.G. 09-01-2001
Checked	A.G. 09-01-2001
Drawn	R.CORNACCHIA

Title: REACTION TRAY INTERFACE

Size	Document Number	Rev
A4	[MA]00193-01	0

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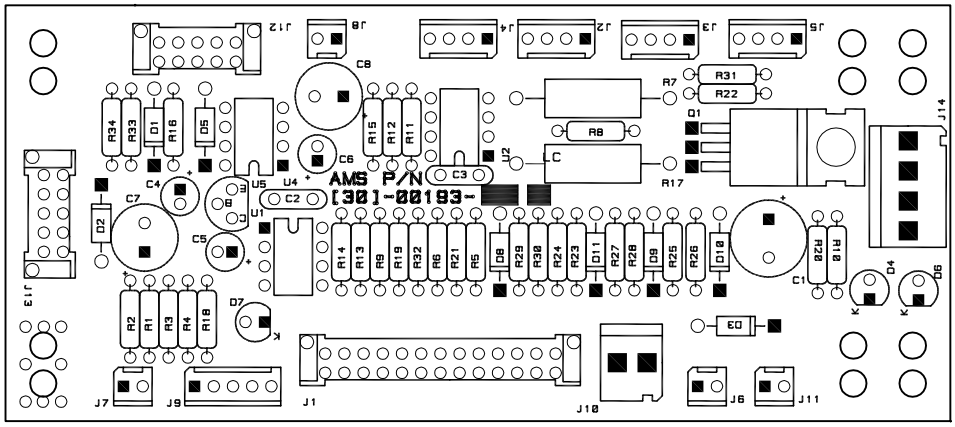
Date: Tuesday, January 09,2001 Sheet 1 of 1



Rev.	Description	Checked	Date	Approved	Date
0	Emission				

Analyzer Medical System
Via Forlanini s.n.c.
(Via Tiburtina km. 18,300)
00012 Guidonia (Roma)

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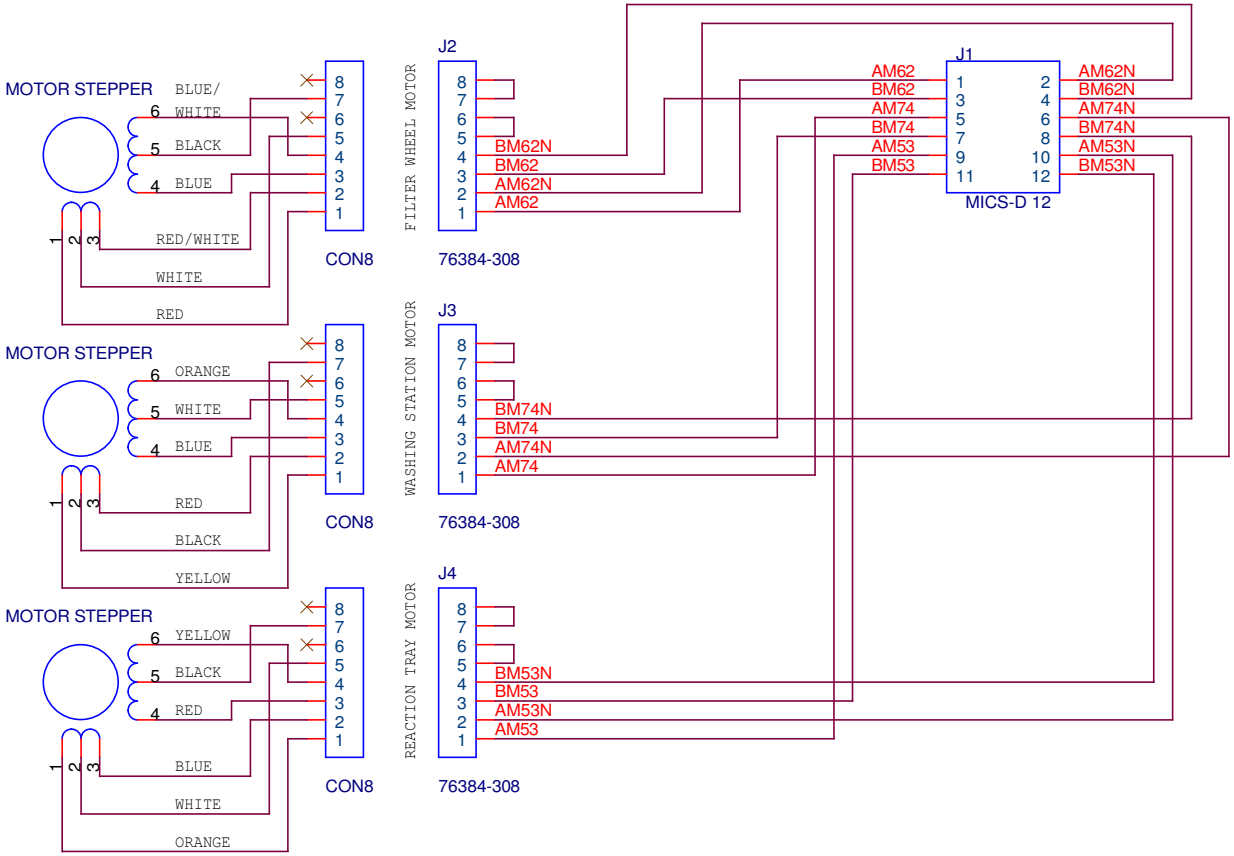
Description: Reaction tray interface	Scale:	Sheet: 1 of 1	Drawn: A.Nicoletti	Date: 04.10.2000
	Car.: [30]	Drawing: 00193-01	Checked: R.Cornacchia	Date: 04.10.2000
		Rev.: 0	Approved: A.Gagliarducci	Date: 04.10.2000



Rev.	Description	Checked	Approved
0	Emission		

AMS Analyzer Medical System

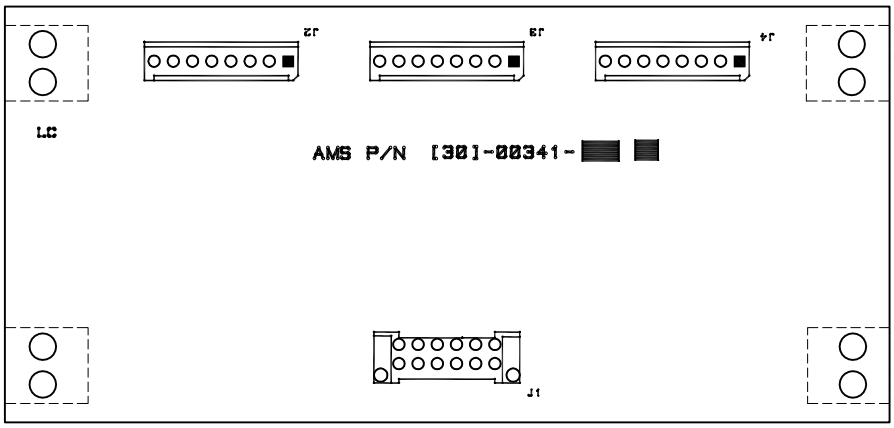
Approved	A.G. 30-05-2001
Checked	A.G. 30-05-2001
Drawn	R.CORNACCHIA

Title: REACTION CHAMBER MOTOR INTERFACE

Size	Document Number	Rev
A4	[MA]00341-00	0

The present drawing is property of AMS any use without authorization will be prosecuted accordingly to the law

Date: Wednesday, May 30, 2001 Sheet 1 of 1



Rev.	Description	Checked	Date	Approved	Date
0	Emission				

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Analyzer Medical System
Via Forlanini s.n.c.
(Via Tiburtina km. 18,300)
00012 Guidonia (Roma)

		Drawn: A.Nicoletti		Date: 30.05.2001
Description: REACTION CHAMBER	Scale: 1:1	Sheet: 1 of 1	Checked: R.Cornacchia	Date: 30.05.2001
MOTOR INTERFACE	Car.: [30] / Drawing: 00341-00	Rev.: 0	Approved: A.Gagliarducci	Date: 30.05.2001

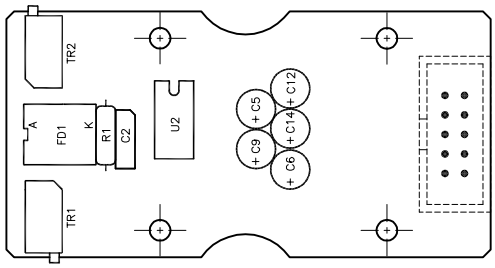


Fig.2

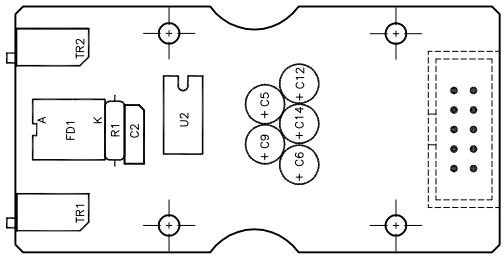
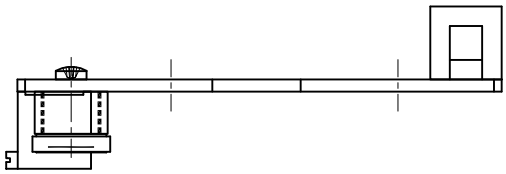
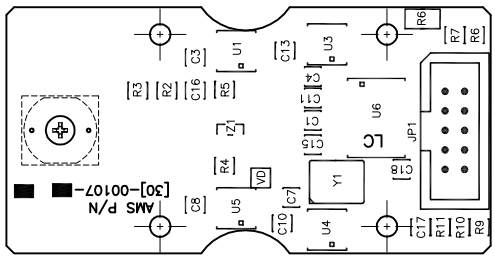


Fig.1





05	Montare TR1 e TR2 come da disegno (Fig.1)+ R1 da 22MOhm (can. rif.)
03	Montare TR1 e TR2 come da disegno (Fig.2) + R1 da 22MOhm (can. rif.)
00	Montare TR1 e TR2 come da disegno (Fig.1) + R1 da 15MOhm (can. prin.)
Sol.	Descrizione

A	Come da richiesta di modifica N°114				
0	Emission	Checked	07.09.2000	Approved	07.09.2000
Rev.	Description	Checked	Date	Approved	Date

AMS Analyzer Medical System
Via Forlanini s.n.c.
(Via Tiburtina km. 18,300)
00012 Guidonia (Roma)

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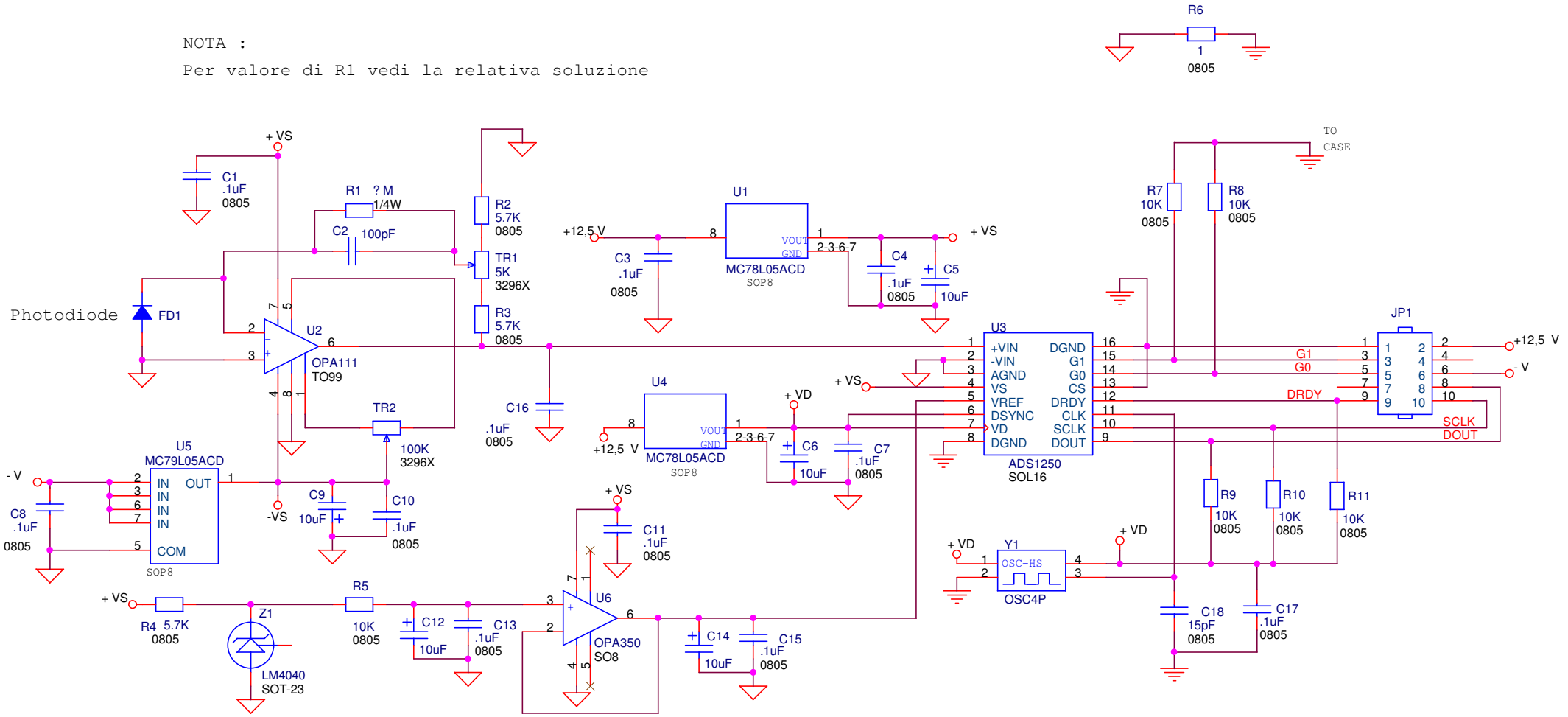
			Drawn G.Pucci		Date 12.02.2002
Description PRE-AMPL/ADC	Scale 1:1	Sheet 1 of 1	Checked L.Mancini		Date 25.05.2002
	Car. [MA]	Drawing 30-00107-XX	Rev. A	Approved A.Gagliarducci	Date 25.05.2002

NOTA :

Per valore di R1 vedi la relativa soluzione



Rev.	Description	Checked	Approved
0	Emission		

Approved	A.G. 25-05-2002
Checked	L.M. 25-05-2002
Drawn	R.CORNACCHIA

AMS Analyzer Medical System

Title: PRE-AMPL/ADC

Size	Document Number	Rev
A4	[MA]00107-00	0

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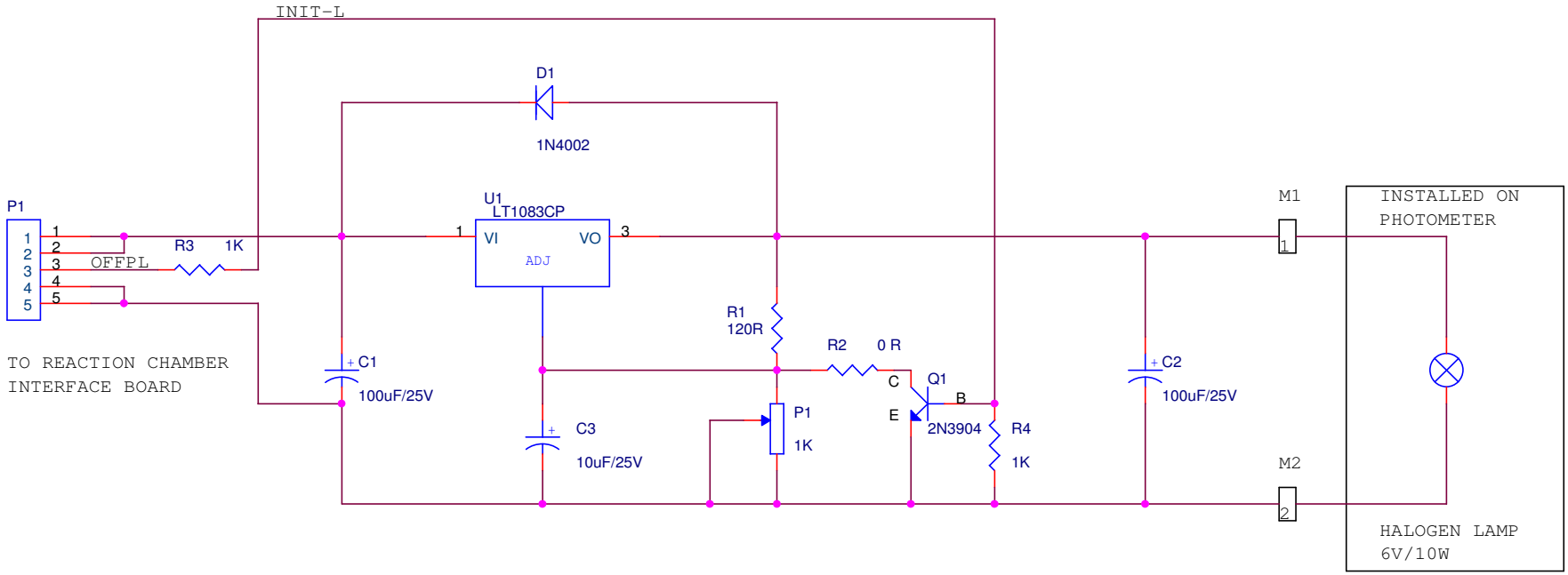
Date: Friday, February 06, 2004 Sheet 1 of 1



Rev.	Description	Checked	Approved
0	Emission		

AMS Analyzer Medical System

Approved	A.G. 12-01-2002
Checked	L.M. 12-01-2002
Drawn	R.CORNACCHIA

Title: PHOTOMETER LAMP PWS

Size	Document Number	Rev
A4	9-[MA]-30-0004-00	0

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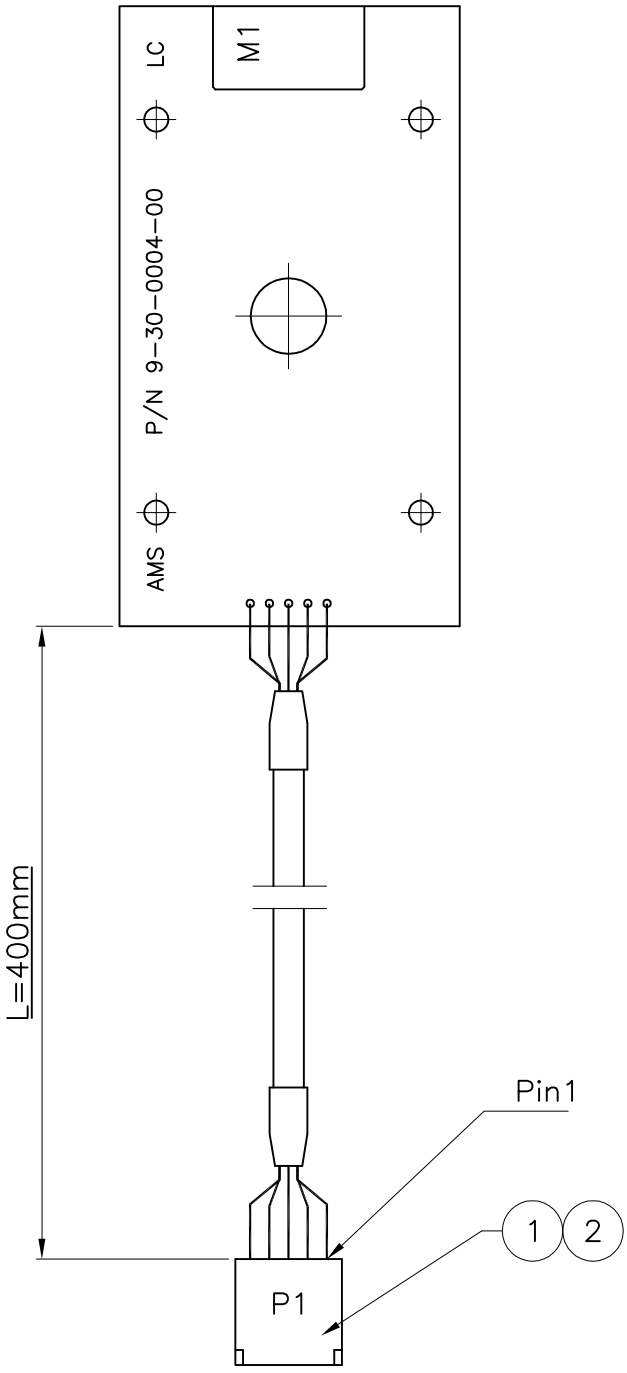
Date: Friday, February 06, 2004 Sheet 1 of 1



CONNECTION	
Board	P1
1	1
2	2
3	3
4	4
5	5

Rev.	Description	Checked	Date	Approved	Date
0	Emission				

AMS Analyzer Medical System
Via Forlanini s.n.c.
(Via Tiburtina km. 18,300)
00012 Guidonia (Roma)

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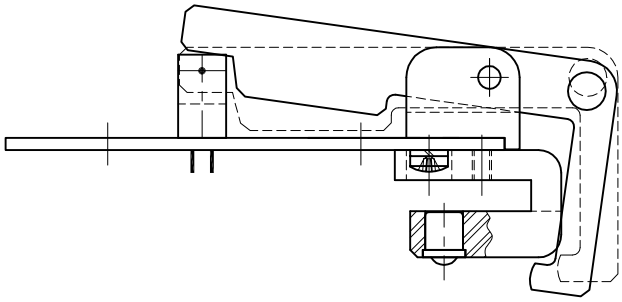
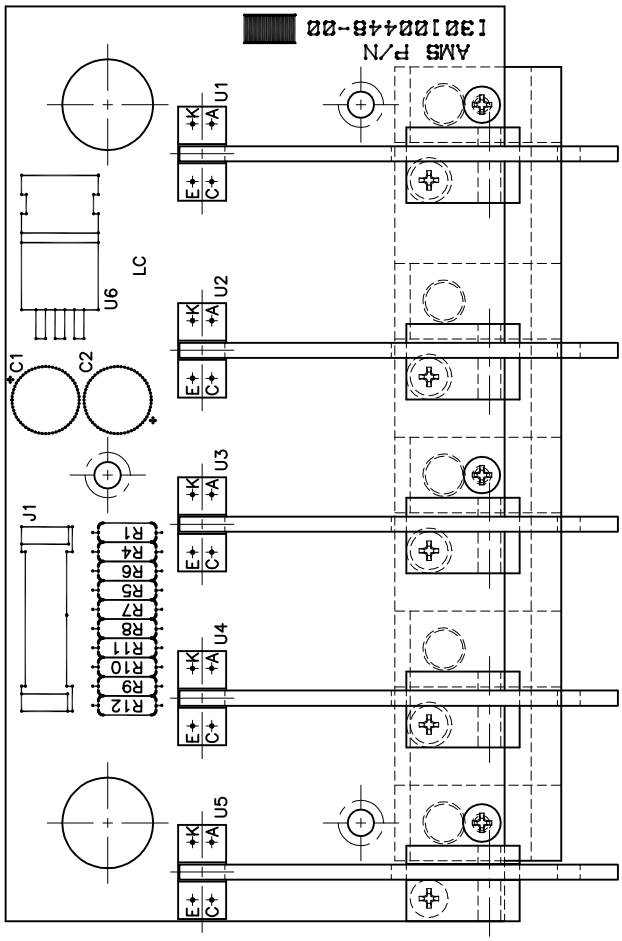
Drawn: G.Pucci — Date: 04.03.99

Description: LAMP PWS BOARD

Scale: 1:1 — Sheet: 1 of 1 — Checked: R.Cornacchia — Date: 04.03.99

Drawing: 9-ME-30-0004-00 — Rev.: 0 — Approved: A.Gagliarducci — Date: 04.03.99





Rev.	Description	Checked	Date	Approved	Date
A	Come da richiesta di modifica N°160 (modificato Rif.1; agg. Rif.2,3,4)				
0	Emission	R.C.	11.01.2002	A.G.	11.01.2002

AMS Analyzer Medical System
Via Forlanini s.n.c.
(Via Tiburtina km. 18,300)
00012 Guidonia (Roma)

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Drawn: G.Pucci — Date: 20.02.2003

Description: SAMPLE RACKS
IDENTIFICATION BOARD

Scale:

Sheet: 1 of 1

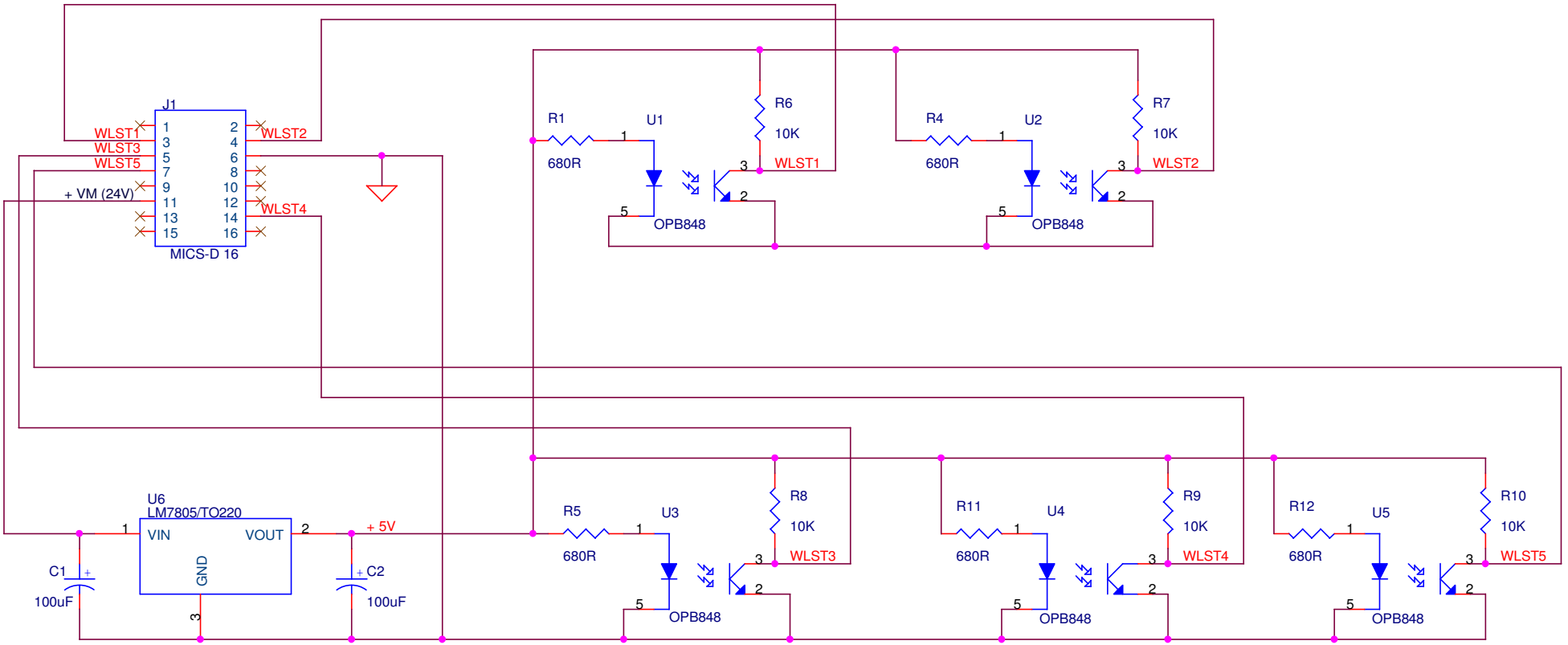
Checked: R.C. — Date: 20.02.2003

Car.: [MA]

Drawing: 30-00446-00

Rev.: A

Approved: A.G. — Date: 20.02.2003



Rev.	Description	Checked	Approved
0	Emission		

AMS Analyzer Medical System

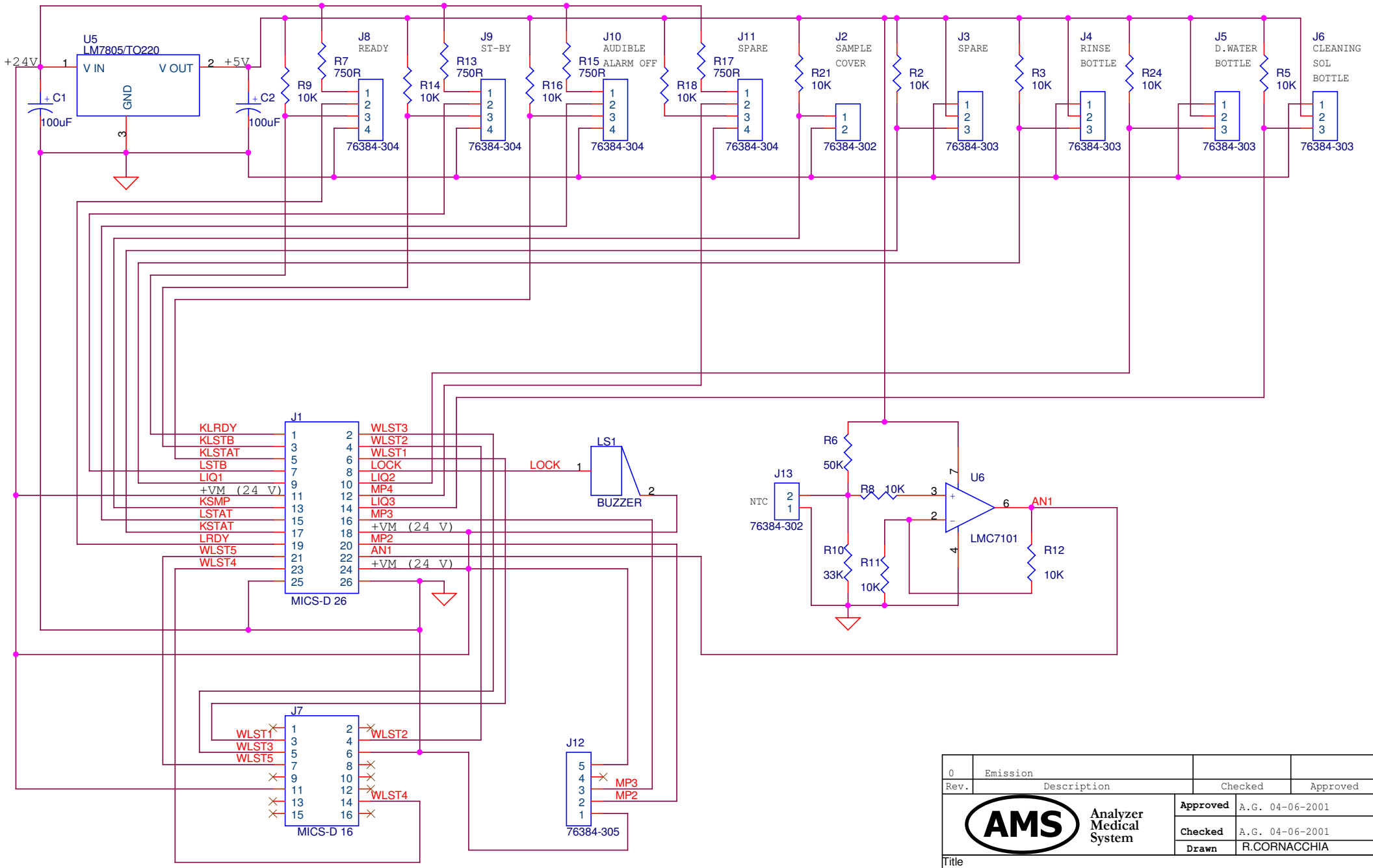
Approved	A.G. 12-1-2002
Checked	A.G. 12-1-2002
Drawn	R.CORNACCHIA

Title: SAMPLE RACKS IDENTIF. BOARD

Size	Document Number	Rev
A4	[MA]00446-00	0

The present drawing is property of AMS any use without authorization will be prosecuted accordingly to the law

Date: Friday, February 06, 2004 Sheet 1 of 1



Rev.	Description	Checked	Approved
0	Emission		

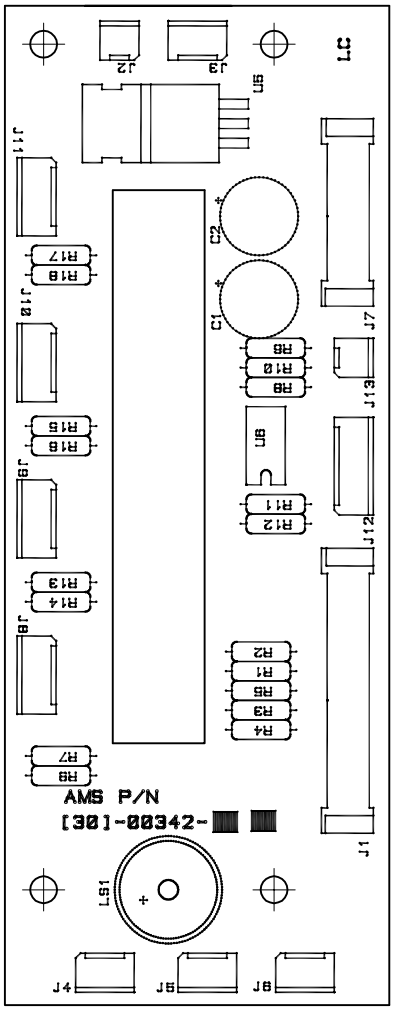
AMS Analyzer Medical System

Approved	A.G. 04-06-2001
Checked	A.G. 04-06-2001
Drawn	R.CORNACCHIA

Title: CONTROL PANEL

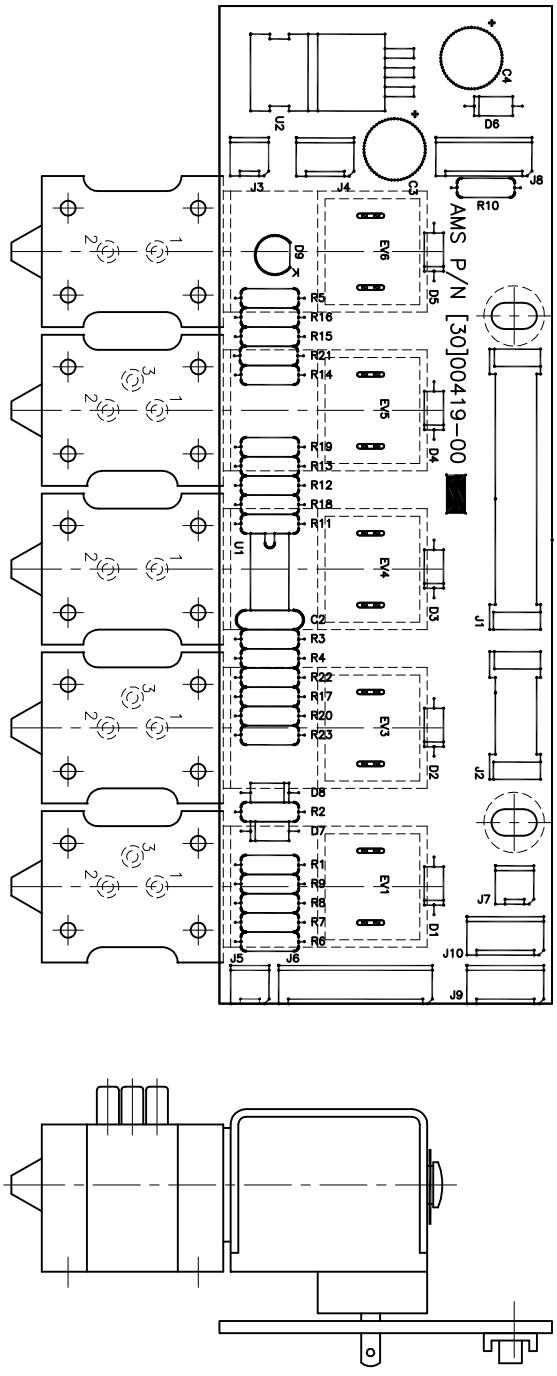
Size	Document Number		Rev
A4	[MA]00342-00	The present drawing is property of AMS any use without authorization will be prosecuted accordingly to the law	0

Date: Monday, June 04,2001 Sheet 1 of 1



Rev.	Description	Checked	Date	Approved	Date
0	Emission				

Material	AMS Analyzer Medical System — Via Forlanini s.n.c. (Via Tiburtina km. 18,300) 00012 Guidonia (Roma)	Drawn: A.Nicoletti	Date: 06.11.2001
		Checked: R.Cornacchia	Date: 06.11.2001
Treatment	The present drawing is property of AMS, any use without authorization will be prosecuted accordingly to the law.	Approved: A.Gagliarducci	Date: 06.11.2001
	Description: Control Panel	Scale: 1:1	Sheet: 1 of 1
Finish		Car.: [30]	Drawing: 00342-00 — Rev.: 0

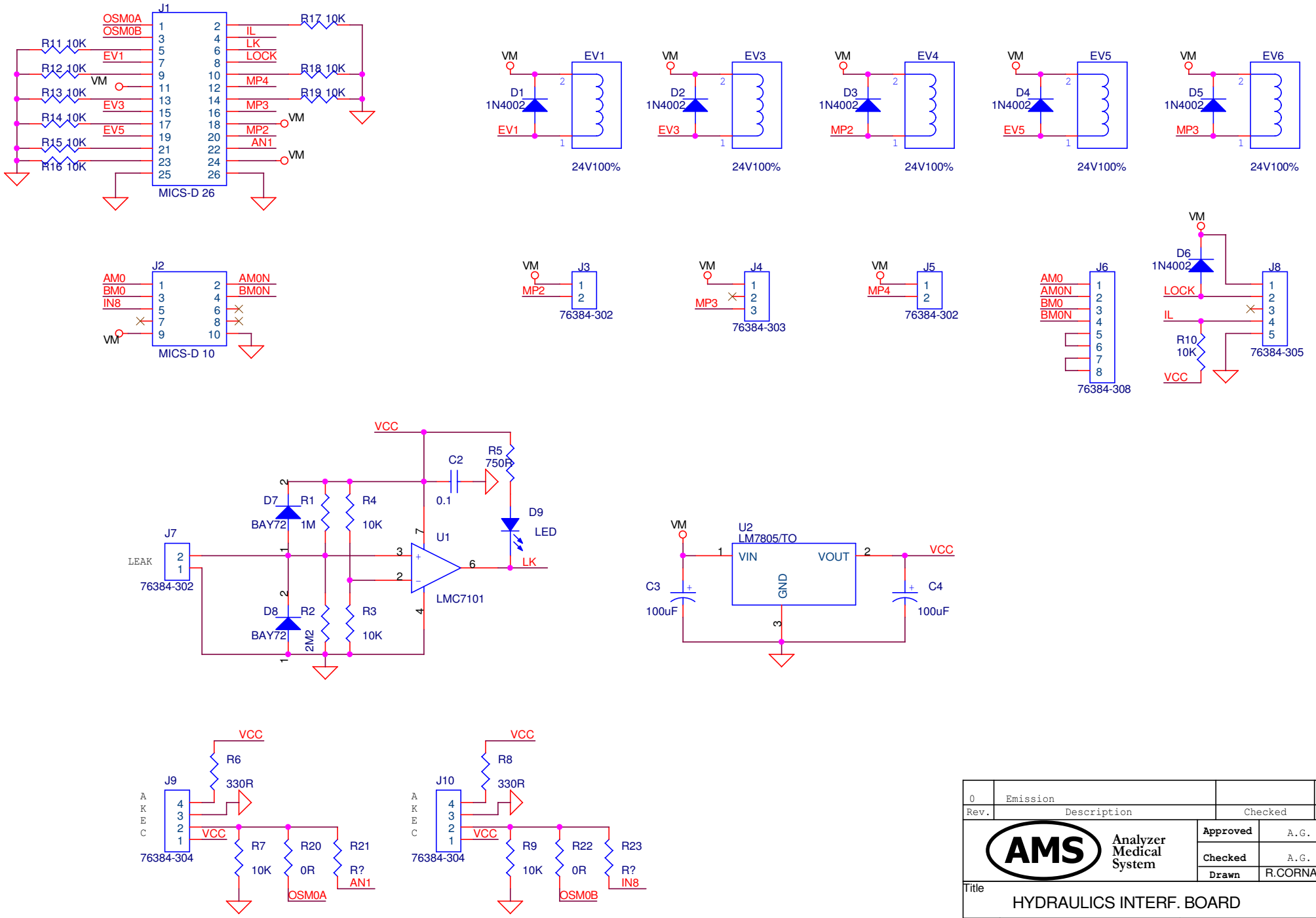


Rev.	Description	Checked	Date	Approved	Date
0	Emission				

AMS Analyzer Medical System
Via Forlanini s.n.c.
(Via Tiburtina km. 18,300)
00012 Guidonia (Roma)

The present drawing is property of AMS, any use without authorization will be prosecuted accordingly to the law.

Description	Scale	Sheet	Drawn	Date
HYDRAULICS INTERFACE BOARD	1:1	1 of 1	G.Pucci	23.11.2001
			Checked R.C.	23.11.2001
	Car. [30]	Drawing 00419-00	Rev. 0	Approved A.G. Date 23.11.2001



Rev.	Description	Checked	Approved
0	Emission		

Approved	A.G. 11-01-2002
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Drawn	R.CORNACCHIA

AMS Analyzer Medical System

Title: HYDRAULICS INTERF. BOARD

Size	Document Number	Rev
A4	[SE]00419-00	0

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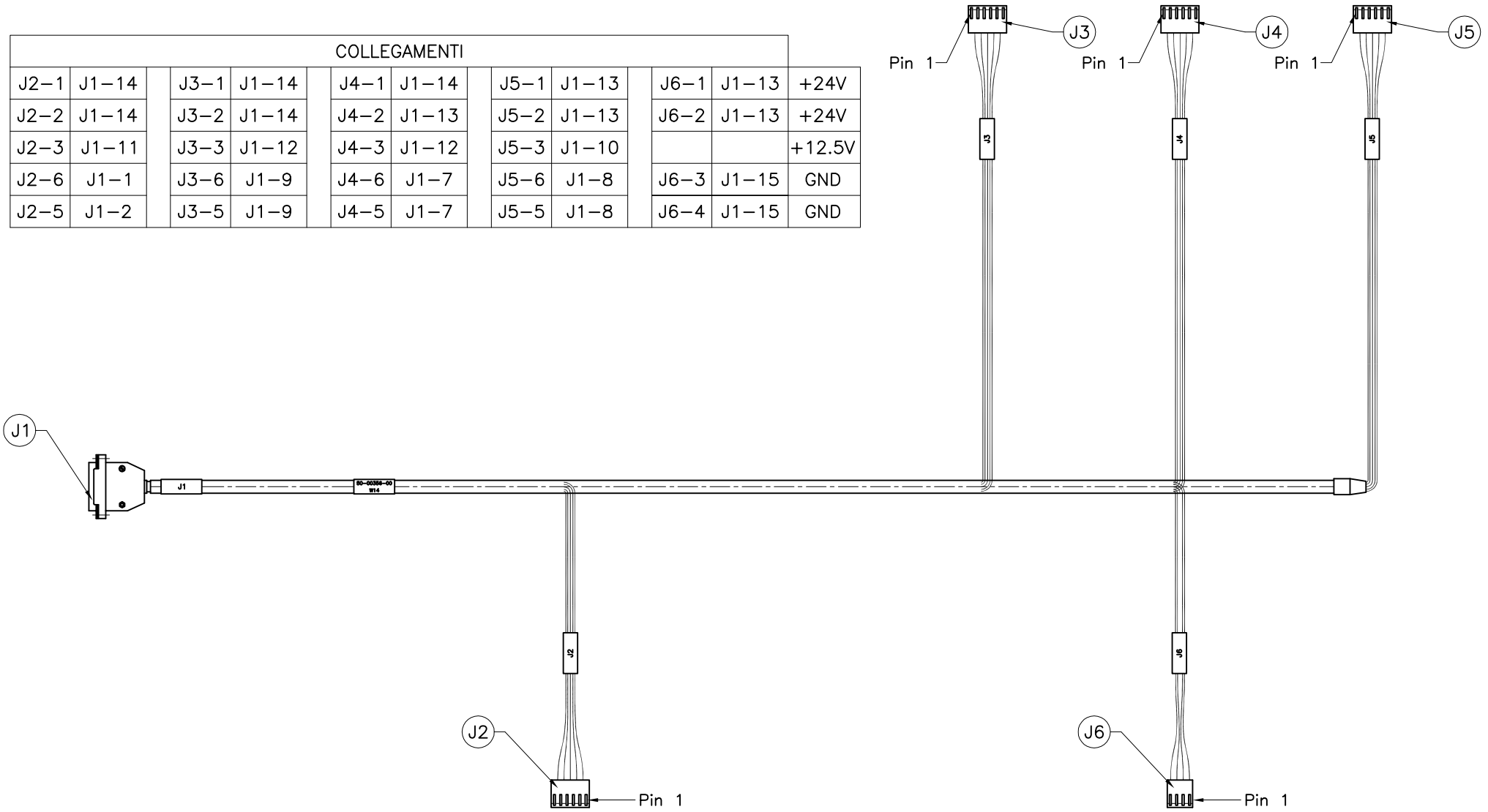
Date: Monday, June 04,2001 Sheet 1 of 1

COLLEGAMENTI											
J2–1	J1–14	J3–1	J1–14	J4–1	J1–14	J5–1	J1–13	J6–1	J1–13	+24V
J2–2	J1–14	J3–2	J1–14	J4–2	J1–13	J5–2	J1–13	J6–2	J1–13	+24V
J2–3	J1–11	J3–3	J1–12	J4–3	J1–12	J5–3	J1–10			+12.5V
J2–6	J1–1	J3–6	J1–9	J4–6	J1–7	J5–6	J1–8	J6–3	J1–15	GND
J2–5	J1–2	J3–5	J1–9	J4–5	J1–7	J5–5	J1–8	J6–4	J1–15	GND



Rev.	Description	Checked	Date	Approved	Date
0	Emission				

AMS Analyzer Medical System
Via Forlanini s.n.c.
(Via Tiburtina km. 18,300)
00012 Guidonia (Roma)

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Description: CAVO ALIMENTAZIONE

Drawn	G.Pucci	Date	18.07.2001
Scale	1:2.5	Sheet	1 of 1
Checked	R.Cornacchia	Date	18.07.2001
Car.	[MA]	Drawing	50–00356–00
Rev.	0	Approved	A.Gagliarducci
Date	18.07.2001		

CHAPTER 05

- DIAGNOSTIC PROGRAM -

INDEX

5 DIAGNOSTIC PROGRAM 3

5.1 STATUS BAR 7

5.2 TEST FOLDER 8

5.3 “ARM” FOLDER 9

5.3.1 VERTICAL COMMAND AREA 10

5.3.2 HORIZONTAL COMMAND AREA 10

5.3.3 STATUS COMMAND AREA 11

5.3.4 ARM SETTING COMMAND AREA 11

5.4 “DILUTER” FOLDER 12

5.4.1 OPERATIONS AREA 13

5.4.2 SENSOR STATE AREA 13

5.4.3 USER AREA 13

5.4.4 STATUS COMMAND AREA 13

5.5 “OPTIC” FOLDER 14

5.5.1 OPERATIONS AREA 15

5.5.2 SENSOR STATE AREA 15

5.5.3 FILTERS AREA 15

5.5.4 DIGITAL CONVERSION AREA 16

5.5.5 STATUS COMMAND AREA 16

5.6 “PLATE” FOLDER 17

5.6.1 OPERATIONS AREA 18

5.6.2 SENSOR STATE AREA 18

5.6.3 USER AREA 18

5.6.4 ALL MOTORS ON/OFF AREA 18

5.6.5 REACTION PLATE AREA 18

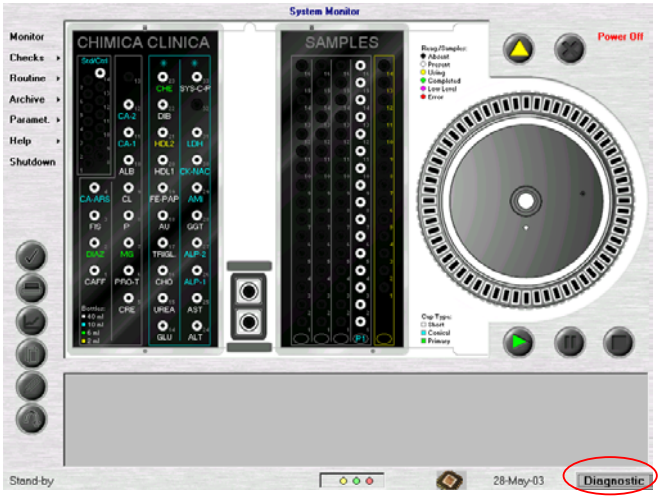
5.6.6 STATUS COMMAND AREA 19

5.7 “TEMPERATURES” FOLDER 19
5.7.1 TEMPERATURES AREA 20
5.7.2 OFFSET AREA 20
5.7.3 TEMPERATURE TEST AREA 20
5.7.4 STATUS COMMAND AREA 21
5.8 “WASH” FOLDER 21
5.8.1 OPERATIONS AREA 22
5.8.2 SENSOR STATUS AREA 22
5.8.3 TEST AREA 22
5.8.4 STATUS COMMAND AREA 25
5.8.5 SENSOR STATE 25
5.9 “USER” FOLDER 25
5.9.1 USER TEST MICRO 1 AREA 26
5.9.2 USER TEST MICRO 2 AREA 26
5.9.3 STATUS COMMAND AREA 26
5.10 “MISCELLANEOUS” FOLDER 27
5.10.1 GENERAL RESET AREA 28
5.10.2 SENSOR CHECKING AREA 28
5.10.3 LOG RAW DATA AREA 28
5.10.4 CONTINUOUS TEST RUN 28
5.10.5 SENSOR STATUS AREA 29
5.10.6 STATUS COMMAND AREA 29
5.11 “GLOBAL SETTING” FOLDER 30
5.11.1 TABLE POSITION 31
5.11.2 KEYBOARD 31
5.11.3 DOWN ARM 32
5.11.4 SETTING OF 32
5.12 “MACRO SETTING” FOLDER 34
5.13 “CONFIGURATION” FOLDER 35
5.14 “ISE” FOLDER 39

5 DIAGNOSTIC PROGRAM

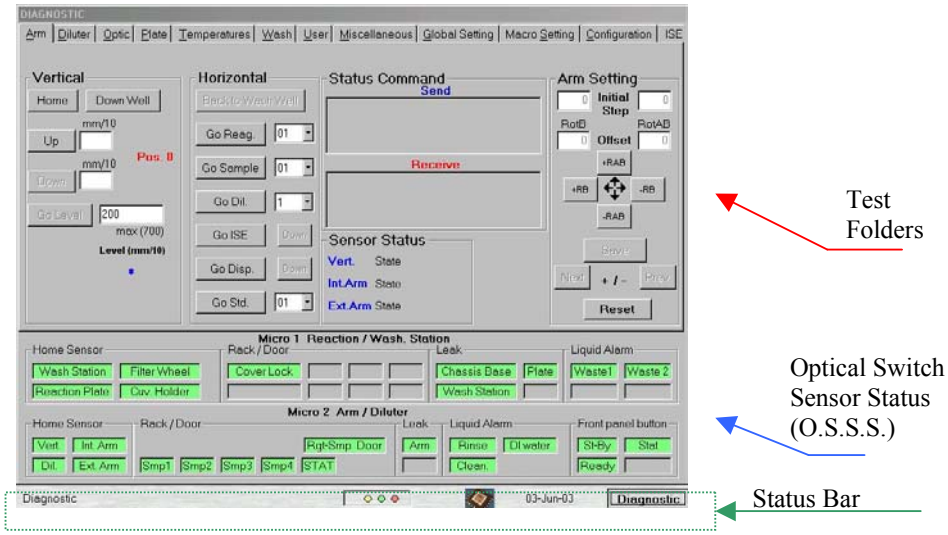
The diagnostic program enables the operator to perform a complete check of each of the Liasys' module functions.
This program has a folder structure, with each folder containing functions pertaining to the specific module. To launch the program the operator has to click with the left side of the mouse, on the **Diagnostic** area located on the lower right side of the screen of the System Monitor (Fig.1).
The Liasys must be in the stand-by state to access this area.

Fig. 1



Once the program starts, the following screen appears (Fig. 2)

Fig. 2



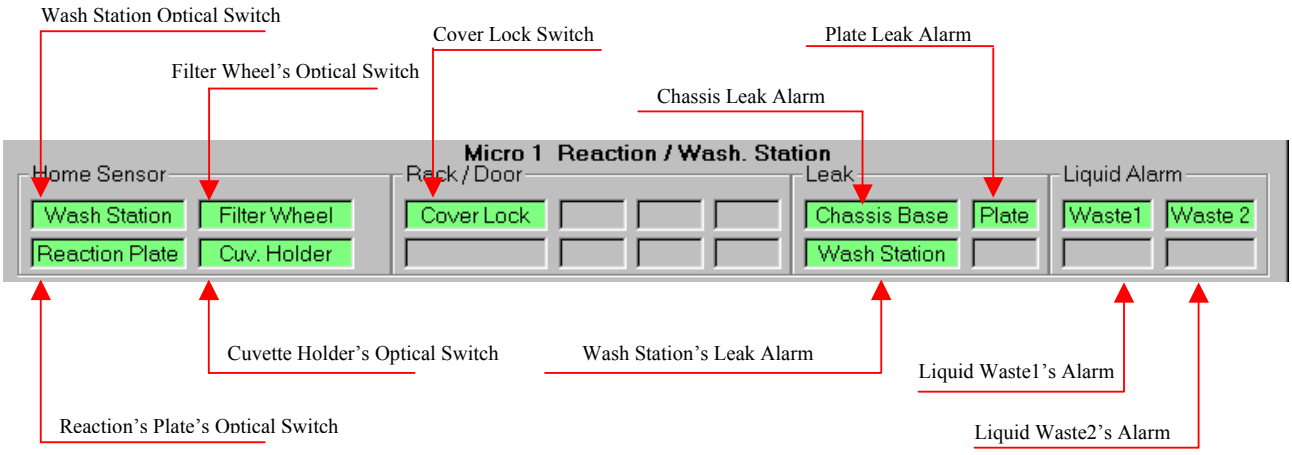
The diagnostic program is subdivided into three distinct areas: test folders, optical switch sensor status (O.S.S.S.), status bar. The last two areas are present on every diagnostic window.

The three areas enable the operator to verify multiple functions as specified below:

Test Folders: checks the functionality of the Liasys' various sub-systems; The individual functions are illustrated later on.

Optical Switch Sensor Status (O.S.S.S.): visualizes the sensor status pertaining to micro 1 that controls the reaction plate and the cuvette wash station (Fig. 3), as well as to micro 2 that manages the arm and the dilutor (Fig. 4)

Fig. 3



Furthermore, there are three types of unused fields: empty, inactive or those reserved for future use. While the program is running, the fields given in the figure can be either of two distinct colors, red or green.

The fields:

- **Wash Station's Optical Switch (O.S.)**
- **Filter Wheel's O.S.**
- **Reaction Plate's O.S.**
- **Cuvette Holder's O.S.**

turn green when the specific device is in the home position, and turn red when not in the home position.

The field

- **Cover Lock**

turns green when the cover is closed, and turns red when open.

The fields:

- **Chassis Leak Alarm** (Instrument Leaking)
- **Wash Station Leak Alarm** (Wash Station Leaking)
- **Plate Leak Alarm** (Reaction Plate Leaking)

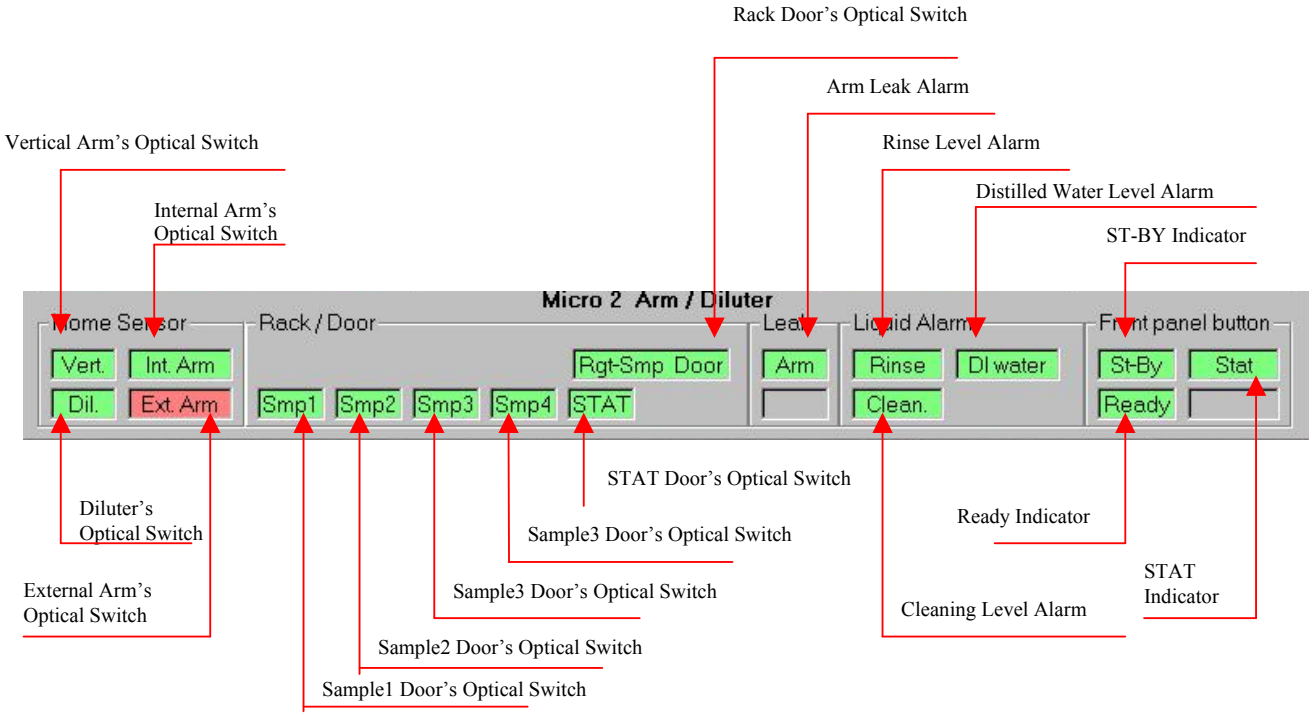
turn green when there is no leaking, and red when there is.

The following two fields signal the alarms for the bottles containing the liquid waste material:

- **Liquid Waste1 Alarm**
- **Liquid Waste2 Alarm**

turning green when the liquid level is not excessive, and red when the waste bottle indicated by the alarm is almost full.

Fig. 4



The fields in the figure can be two different colors: either green or red (for the indicators in Home Sensor, Leak, Liquid Alarm and front panel button), and either green or dark gray (for the indicators in Rack/Door except for the field Rgt-Smp Door that can be either green or red).

The fields:

- **Vertical Arm's O.S.**
- **Internal Arm's O.S.**
- **External Arm's O.S.**
- **Diluter O.S.**

turn green when the relative device is in the Home position, and turn red when the relative device is not in the Home position.

The following fields signal the presence of the rack in the appropriate home position (reagents, samples, standard and controls):

- **Sample1 Rack's O.S.**
- **Sample2 Rack's O.S.**
- **Sample3 Rack's O.S.**
- **Sample4 Rack's O.S.**
- **Sample 5 Rack's O.S. (STAT)**

turn green when the rack is in the appropriate home position, and turn dark gray when the rack is not present (not inserted).

The field below signals the general door opening of any of the racks:

- **Rack Door's O.S.**

turns red when the door is open, and green when the door is closed.

The field below signals the Liasys's arm leak alarm:

- **Arm Leak Alarm**

turns green if there is no leaking, and red if there is.

The following fields check the liquid level of the distribution/loading bottles:

- **Rinse Level Alarm**
- **Distilled Water Level Alarm**
- **Cleaning Level Alarm**

turning green if the liquid level is above the predetermined minimum limit, and red if the liquid quantity is below the predetermined minimum level (the bottle is almost empty).

The following fields signal the state of the button on the Liasys's operator panel:

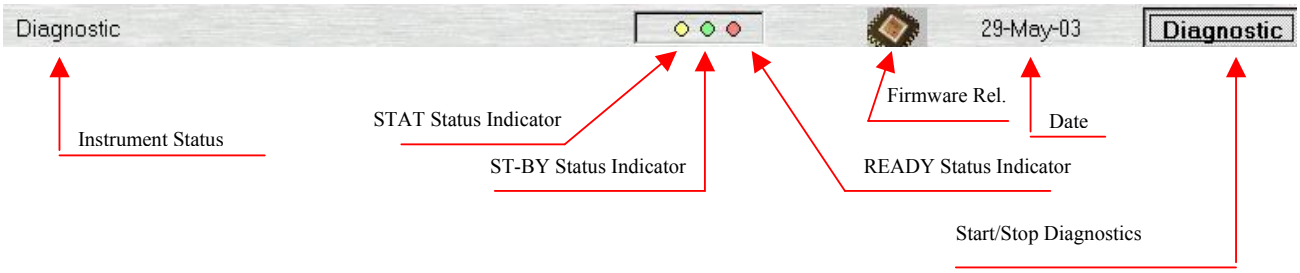
- **ST-BY Indicator**
- **STAT Indicator**
- **READY Indicator**

turning green when the button is not pushed in, and red if it is.

5.1 STATUS BAR

Monitors the instrument's status while the program is running (Fig.5).

Fig. 5



5.2 TEST FOLDER

The following is a summary of each individual test folder'function.
The Liasys's diagnostic program is subdivided into 12 folders:

Arm: checks if the arm is functioning correctly;

Diluter: checks if the diluter is functioning correctly;

Optic: checks if the optical block is functioning correctly;

Plate: checks if the reaction plate is functioning correctly;

Temperature: checks the temperature of the pre-heater and reaction plate;

Wash: checks if the wash station is functioning correctly;

User: checks if the user functions are working properly;

Miscellaneous: performs general checks;

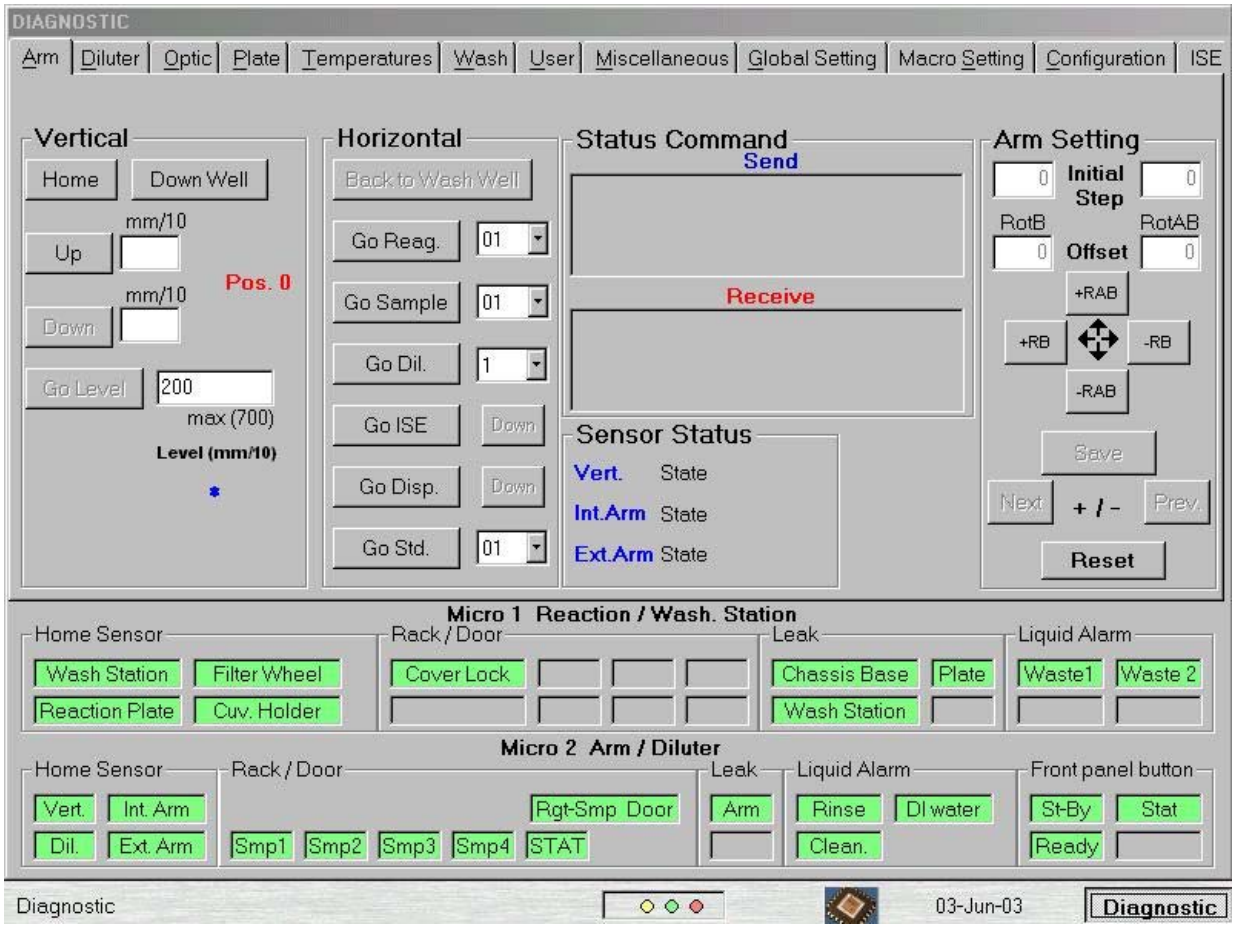
Global Setting: the adjustment of the arm position can be checked;

Macro Setting: the operator can identify which macros have been loaded;

Configuration: Through the use of a password, only qualified technical personal can adjust certain parameters (This file is not accessible to the Laboratory operator).

ISE: Checks if the ISE Module is functioning properly and allows the operator to do maintenance or repair operations.

5.3 "ARM" FOLDER



Warning: the improper use of the functions described in this folder can damage the sampling probe.

The Arm File is subdivided into four areas:

- **VERTICAL**
- **HORIZONTAL**
- **STATUS COMMAND**
- **ARM SETTING**

5.3.1 VERTICAL COMMAND AREA

(5 commands)

Home: Brings the arm vertically to a home position;

Down Well: Brings the arm's axis "z" to the height of the well;

Up: Raises the arm tenths of a millimeter as preset in the square found immediately on the right;

Down: Lowers the arm tenths of a millimeter as pre-determined by the square found immediately on the right;

Go Level: Brings the probe to either the reagent level, the sample or the standard and reads the level. Before giving this command, it is necessary to set the parameter for the probe's maximum lowering level in the max area (mm);

5.3.2 HORIZONTAL COMMAND AREA

(7 commands)

Back to wash well: Brings the arm back to the home position;

Go Reag.: Brings the arm to the reagent position specified in the sheet menu next to the command;

Go Sample: Brings the arm to the sample position specified in the sheet menu next to the command;

Go Dil.: Brings the arm to the dilution position specified in the sheet menu next to the command;

Go ISE: Brings the arm to the ISE position;

Go Disp.: Brings the arm to the dispense position;

Go Std.: Brings the arm to the standard/control position specified in the sheet menu next to the command;

5.3.3 STATUS COMMAND AREA

Send: Visualizes the commands sent from the program to the instrument hardware;

Receive: Visualizes the answers of the instrument's hardware to the commands sent by the program;

Sensor State: Indicates the sensor status relative to the arm's vertical axis, the internal arm and the external arm.

5.3.4 ARM SETTING COMMAND AREA

(8 commands)

+RAB: Performs the clockwise rotation of the two arms (to adjust the position);

-RAB: Performs the counter-clockwise rotation of the two arms (to adjust the position);

+RB: Performs the clockwise rotation of the external arm (to adjust the position);

-RB: Performs the clockwise rotation of the external arm (to adjust the position);

Save: Saves the adjustment data;

Next: Brings the arm to the next sample, standard, dilution or reagent position

Prev.: Brings the arm to the previous sample, standard, dilution or reagent position

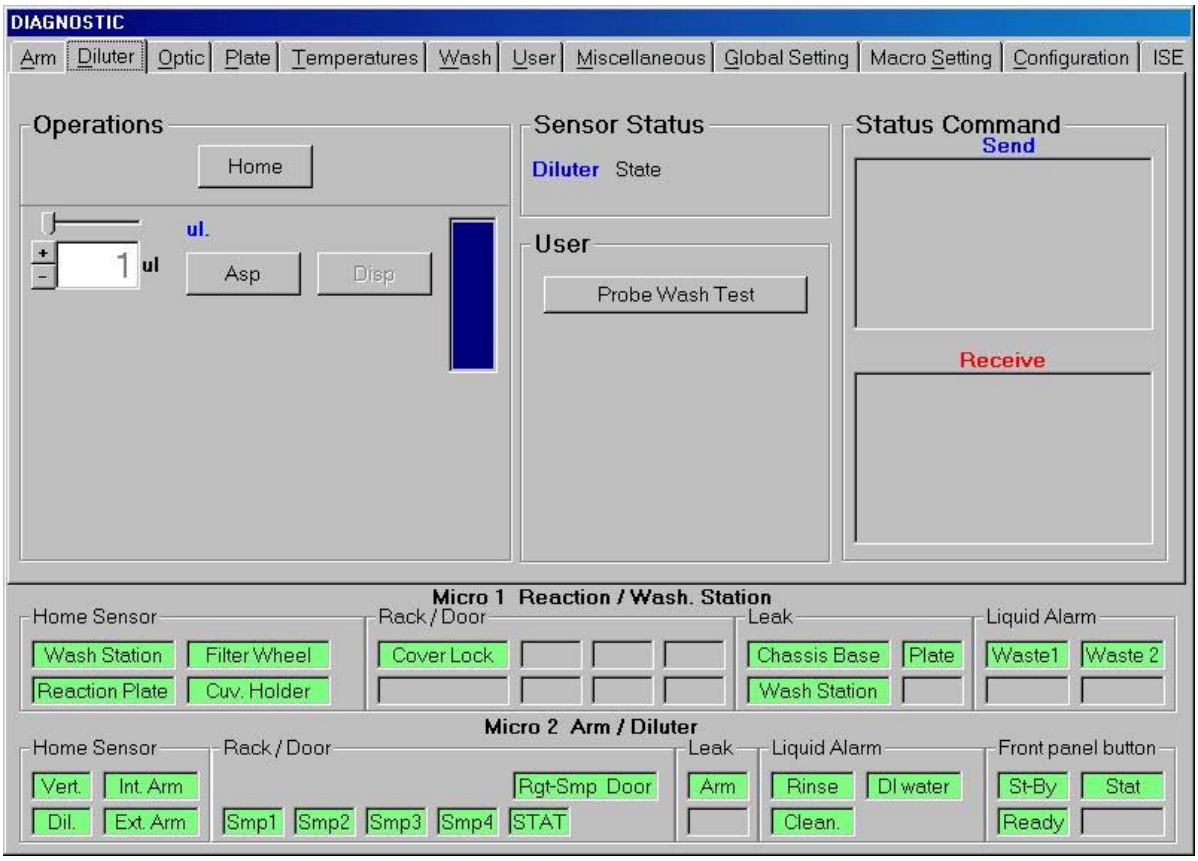
Reset: Completely resets the arm

In this area the boxes can be activated when the arm is positioned on a sample, a reagent, a standard or a control:

Original step: Visualizes the number of base steps.

Offset: Visualizes the number of offset steps.

5.4 "DILUTER" FOLDER



The Diluter Folder is subdivided into four areas:

- **OPERATIONS**
- **SENSOR STATE**
- **USER**
- **STATUS COMMAND**

5.4.1 OPERATIONS AREA

(3 commands)

Home: Brings the diluter to the Home position;

Asp: Aspirates the micro-litres as predetermined in the ul. box (may be set manually through + and – or by using the cursor located immediately above);

Disp.: Distributes the micro-litres as predetermined in the ul. box (may be set manually through + and – or by using the cursor located immediately above);

5.4.2 SENSOR STATE AREA

In the Sensor State area the diluter sensor status is indicated.

5.4.3 USER AREA

(1 command)

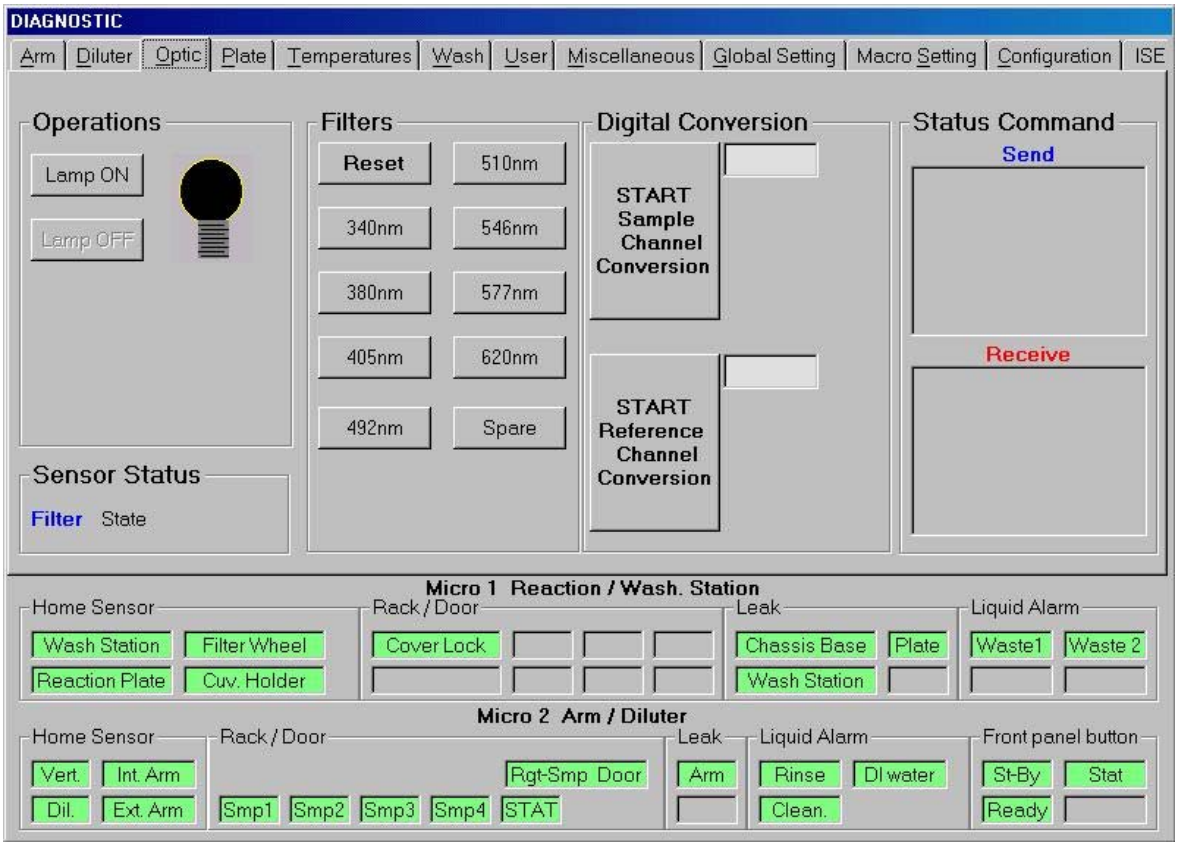
Probe Wash Test: Activates and deactivates the probe wash system

5.4.4 STATUS COMMAND AREA

Send: Visualizes the commands sent by the program to the instrument hardware;

Receive: Visualizes the instrument hardware's response to the commands sent by the program.

5.5 “OPTIC” FOLDER



The Optic folder is subdivided into five areas:

- **OPERATIONS**
- **SENSOR STATUS**
- **FILTERS**
- **DIGITAL CONVERSION**
- **STATUS COMMAND**

5.5.1 OPERATIONS AREA

(2 commands)

Lamp ON: Turns on the Optic Lamp;

Lamp OFF: Turns off the Optic Lamp;

5.5.2 SENSOR STATE AREA

This area indicates the status of the wheel filters.

5.5.3 FILTERS AREA

(10 commands)

Reset : Positions the wheel filters in home position (dark);

340 nm: Positions filter n° 1 in front of the reading sensor;

380 nm: Positions filter n° 2 in front of the reading sensor;

405 nm: Positions filter n° 3 in front of the reading sensor;;

492 nm: Positions filter n° 4 in front of the reading sensor;

510 nm: Positions filter n° 5 in front of the reading sensor;

546 nm: Positions filter n° 6 in front of the reading sensor;

577 nm: Positions filter n° 7 in front of the reading sensor;

620 nm: Positions filter n° 8 in front of the reading sensor;

Spare: Positions filter n° 9 in front of the reading sensor (Optional);

5.5.4 DIGITAL CONVERSION AREA

(2 commands)

START/STOP Sample Channel Conversion: Performs an analogical/digital conversion of the principal channel;

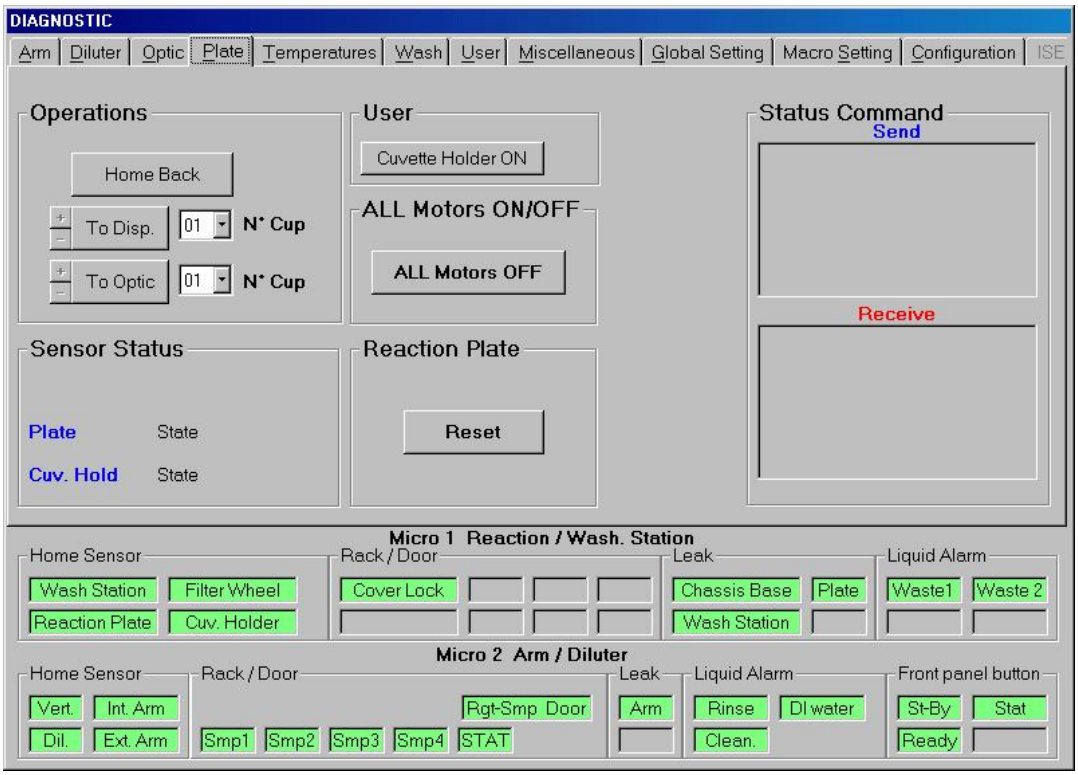
START/STOP Reference Channel Conversion: Performs an analogical/digital conversion of the reference channel;

5.5.5 STATUS COMMAND AREA

Send: Visualizes the commands sent by the program to the instrument hardware;

Receive: Visualizes the instrument hardware's response to the commands sent by the program.

5.6 "PLATE" FOLDER



The Plate Folder is subdivided into six areas:

- **OPERATIONS**
- **SENSOR STATUS**
- **USER**
- **ALL MOTORS ON/OFF**
- **REACTION PLATE**
- **STATUS COMMAND**

5.6.1 OPERATIONS AREA

(3 commands)

Home Back: Performs the same movement as made previously, but in the opposite direction

To Disp.: Automatically positions the cuvette, indicated on the sheet menu aside, under the dispensing position

To Optic: Automatically positions the cuvette, indicated on the sheet menu aside, in front of the colorimeter.

5.6.2 SENSOR STATE AREA

The status of the plate sensor is indicated in this area.

5.6.3 USER AREA

(1 command)

Cuvette Holder ON/OFF: Alternately turns ON and OFF the cuvette holder.

5.6.4 ALL MOTORS ON/OFF AREA

(1 command)

ALL Motors ON/OFF: Engages/Disengages the motors to allow a manual movement of the modules (Sampling Arm, Reaction Plate, Washing Station, Filter Wheel and Peristaltic Pump).

5.6.5 REACTION PLATE AREA

(1 command)

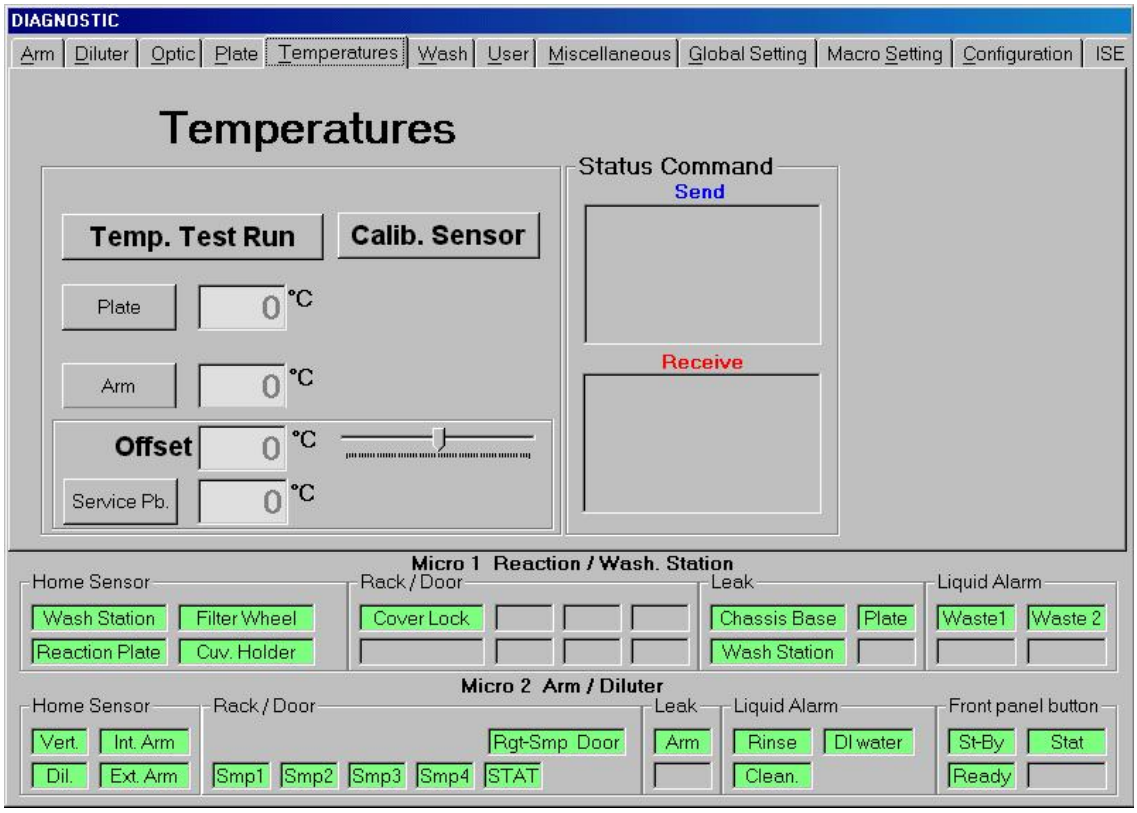
Reset: Performs the reset of the reaction plate by positioning the # 1 cuvette in the dispensing position (reaction disp.).

5.6.6 STATUS COMMAND AREA

Send: Visualizes the commands sent by the program to the instrument hardware;

Receive: Visualizes the instrument hardware's response to the commands received from the program.

5.7 "TEMPERATURES" FOLDER



The Temperature Folder is subdivided into three areas:

Temperatures

Offset

Status Command

5.7.1 TEMPERATURES AREA

(4 commands)

Temp. Test Run: To enter in the Temperature Test folder

Plate: Performs a temperature reading in the reaction plate compartment;

Arm: Performs a temperature reading in the arm's pre-heater.

Calib. Sensor: To carry out the calibration procedure of the thermometric probe included in the kit P/N 55-01204-00, as illustrated in Chapter Six "Settings and Adjustments".

5.7.2 OFFSET AREA

(2 commands)

To correlate the thermometric probe included in the kit P/N 55-01204-00 with another reference thermometric probe.

Service probe: The offset value that has been previously inserted and the temperature value read by the thermometric probe appear in the closed fields.

Cursore: To enter the offset value ± 3 C°. The offset value will be zero after exiting from the folder.

5.7.3 TEMPERATURE TEST AREA

(3 commands)

START: To perform the test check and to regulate the temperature of the preheater and of the reaction plate by using the kit P/N 55-01204-00, as illustrated in Chapter 6 "Setting and Adjustments".
The number of sample cycles are predefined, whereas the reagent and sample positions for test execution can be selected by the operator.

Service Probe: the field in which the temperature of the service probe appears.

WASH: To run a wash cycle on the cuvettes used for testing.

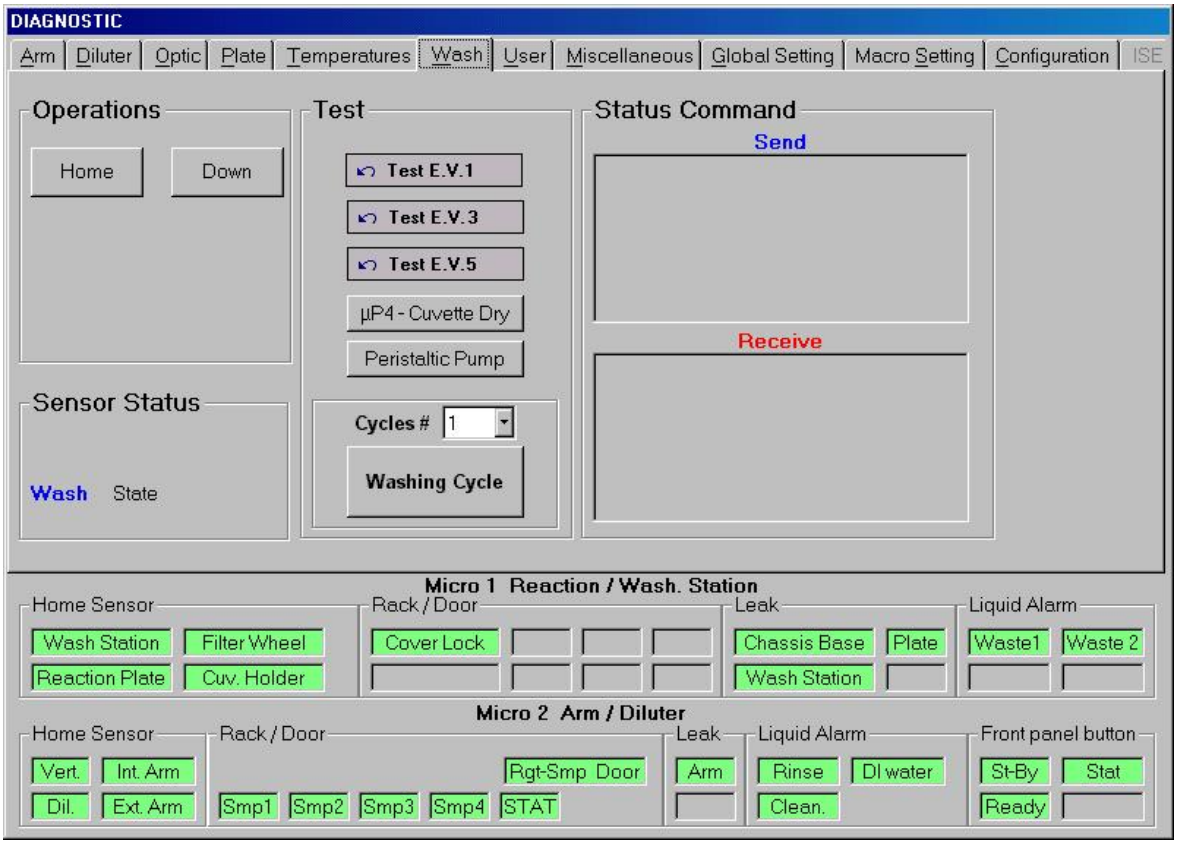
EXIT: To exit from the Temperature Test box and to run a wash cycle on the cuvettes if they have been used.

5.7.4 STATUS COMMAND AREA

Send: Visualizes the commands sent by the program to the instrument hardware;

Receive: Visualizes the instrument hardware's response to the commands sent by the program.

5.8 "WASH" FOLDER



The Wash folder is subdivided into four areas:

- **OPERATIONS**
- **SENSOR STATUS**
- **TEST**
- **STATUS COMMAND**

5.8.1 OPERATIONS AREA

(2 commands)

Home: Brings the washing device to the Home position;

Down: Makes the washing device go down to the washing position.

5.8.2 SENSOR STATUS AREA

In this area the sensor state of the wash station is indicated.

5.8.3 TEST AREA

(6 commands)

Test E.V. 1: Performs switching ON/OFF of the solenoid valve three times;

Test E.V. 3: Performs switching ON/OFF of the solenoid valve three times;

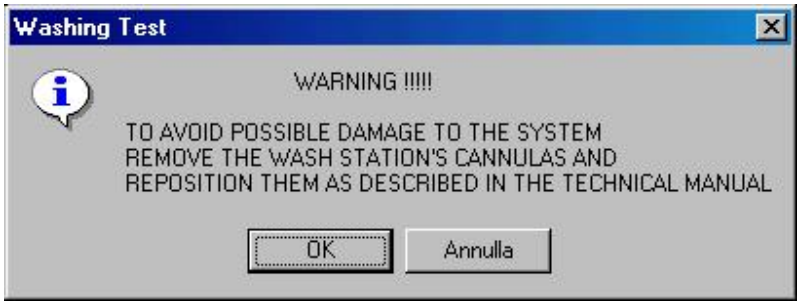
Test E.V. 5: Performs switching ON/OFF of the solenoid valve three times;

µP4 – Cuvette Dry: It turns on the µP4 pump and automatically turns it off after a period of four seconds.

Peristaltic Pump: It turns on the peristaltic pump and automatically turns it off after one second.

Washing Cycle: It performs the functional check of the Washing Station through the following steps:

- Select, in the "Cycle #" field, the number of washing cycles to be performed from 1 to 10 and press the "Washing Cycle" key.
- The following window appears:



- Remove the Washing Station top cover fastening screw
- Remove the Washing Station top cover and the five springs located on top of the probes
- Take out from their site the four probes and put three cuvettes in position number 1,2 and 3 (See fig.1)

Fig. 1

- Put the first two probes respectively into the first and the second cuvettes, then put the other two probes together into the third cuvette and press the “OK” key
- By referring to the window here below, push the “OK” key to start the Washing Cycle

- Check that the three cuvettes are correctly filled and emptied (Fig. 1)
- Remove the aspiration tube from the first two probes, (they are signed as "A" and "B"), then remove only the aspiration probe from the third cuvette and **start with only one Washing cycle** (Fig.2)

Fig.2

Attention: select only one washing cycle in order to avoid cuvettes overflow

- Dispensed volumes shall be: 800 µL ± 100 into the first cuvette
  1200 µL ± 150 into the second cuvette
  400 µL ± 50 into the third cuvette

5.8.4 STATUS COMMAND AREA

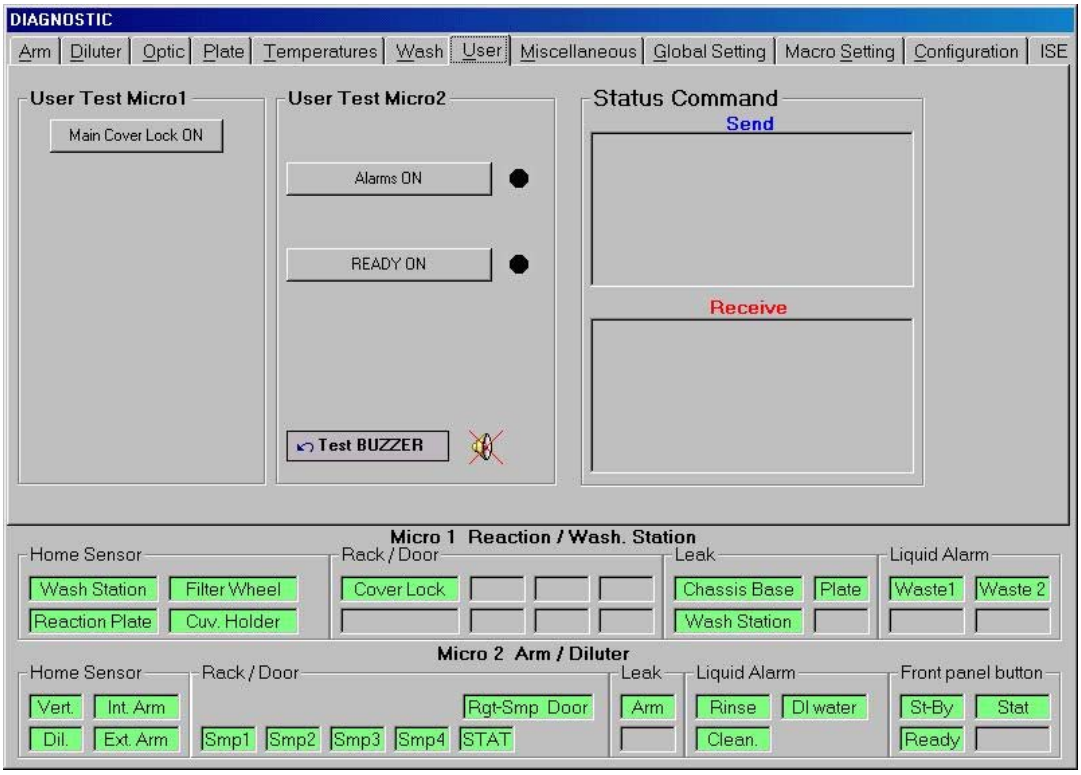
Send: Visualizes the commands sent by the program to the instrument hardware;

Receive: Visualizes the instrument hardware's response to the commands sent by the program.

5.8.5 SENSOR STATE

- **TEST**
- **STATUS COMMAND**

5.9 "USER" FOLDER



The User File is subdivided into three areas:

- **USER TEST MICRO 1**
- **USER TEST MICRO 2**
- **STATUS COMMAND**

5.9.1 USER TEST MICRO 1 AREA

(1 command)

Main Cover Lock ON/OFF: Alternatively turns on or off the solenoid valve holder and releases the main cover lock.

5.9.2 USER TEST MICRO 2 AREA

(3 commands)

Alarms ON/OFF: Turns on and off the STAT indicator lamp;

Ready ON/OFF: Turns on and off the READY indicator lamp;

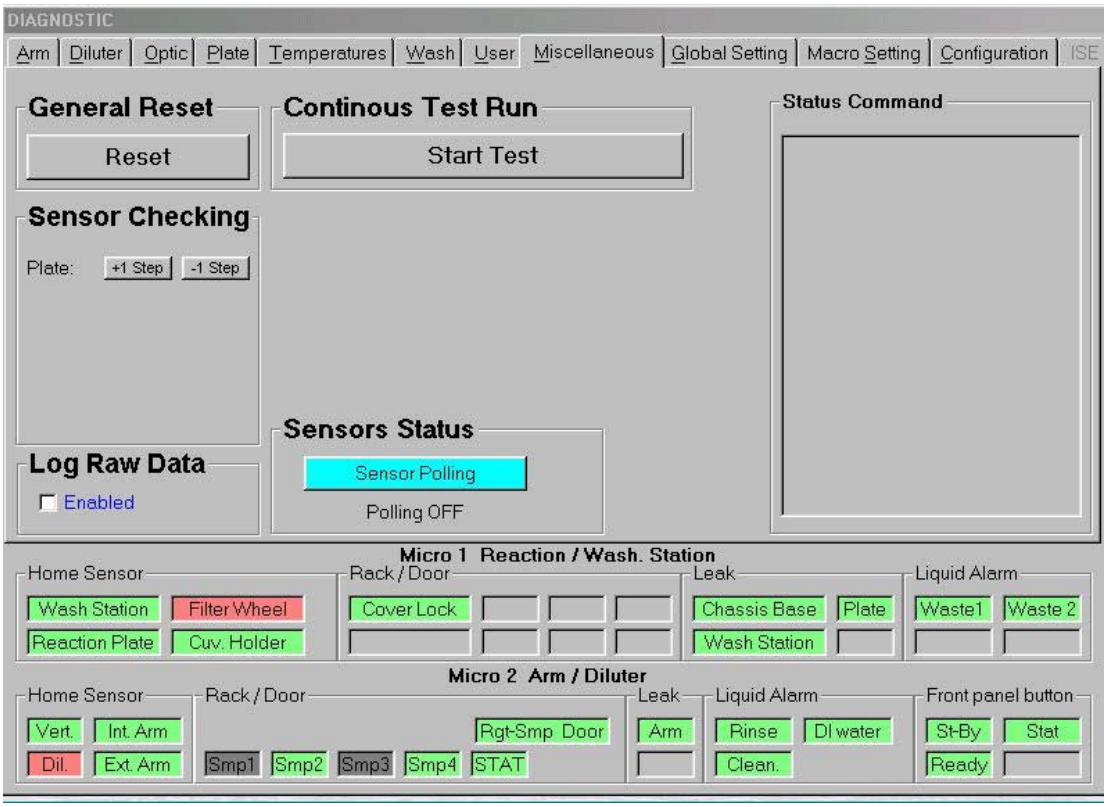
Test BUZZER: Performs a complete operational test of the buzzer;

5.9.3 STATUS COMMAND AREA

Send: Visualizes the commands sent by the program to the instrument hardware;

Receive: Visualizes the instrument hardware's response to the commands sent by the program.

5.10 "MISCELLANEOUS" FOLDER



The Miscellaneous folder is subdivided into six areas:

- **General Reset**
- **Sensor Checking**
- **Log Raw data**
- **Continuous Test Run**
- **Sensor Status**
- **Status Command**

5.10.1 GENERAL RESET AREA

(1 command)

Reset: Performs the resetting of the general system.

5.10.2 SENSOR CHECKING AREA

(2 commands)

Plate + 1 Step: To turn the reaction plate in a counter-clockwise direction to check the home sensor.

Plate - 1 Step: To turn the reaction plate in a clockwise direction to check the home sensor.

5.10.3 LOG RAW DATA AREA

(1 command)

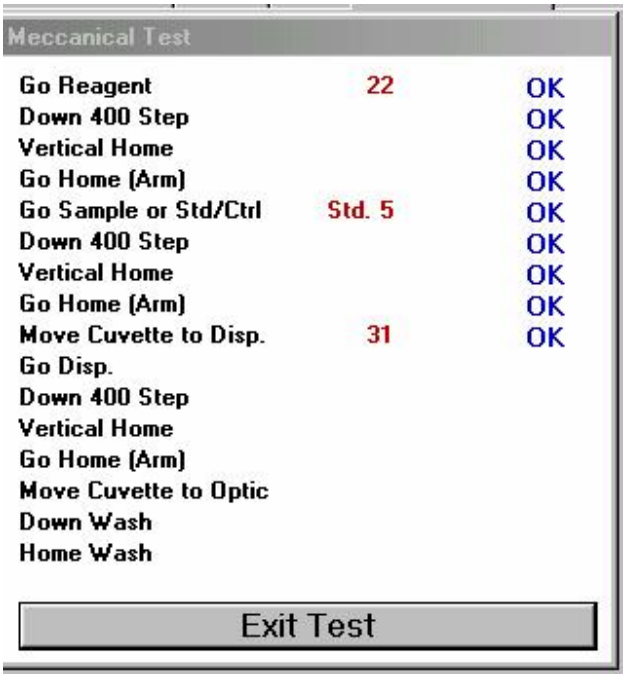
Enable: To save a copy of the files for the technical diagnosis if the instrument malfunctions. The files are memorized in the folder "Log" inside the folder "Analyzer".

5.10.4 CONTINUOUS TEST RUN

(1 command)

Start Test: Performs an automatic test during which the modules (Sampling Arm, Reaction plate, Washing Station and Photometer) are moved to all the different positions.

The correct modules positioning is also automatically verified and showed on the following table:



To stop the test push on the "Exit Test" key

5.10.5 SENSOR STATUS AREA

(1 command)

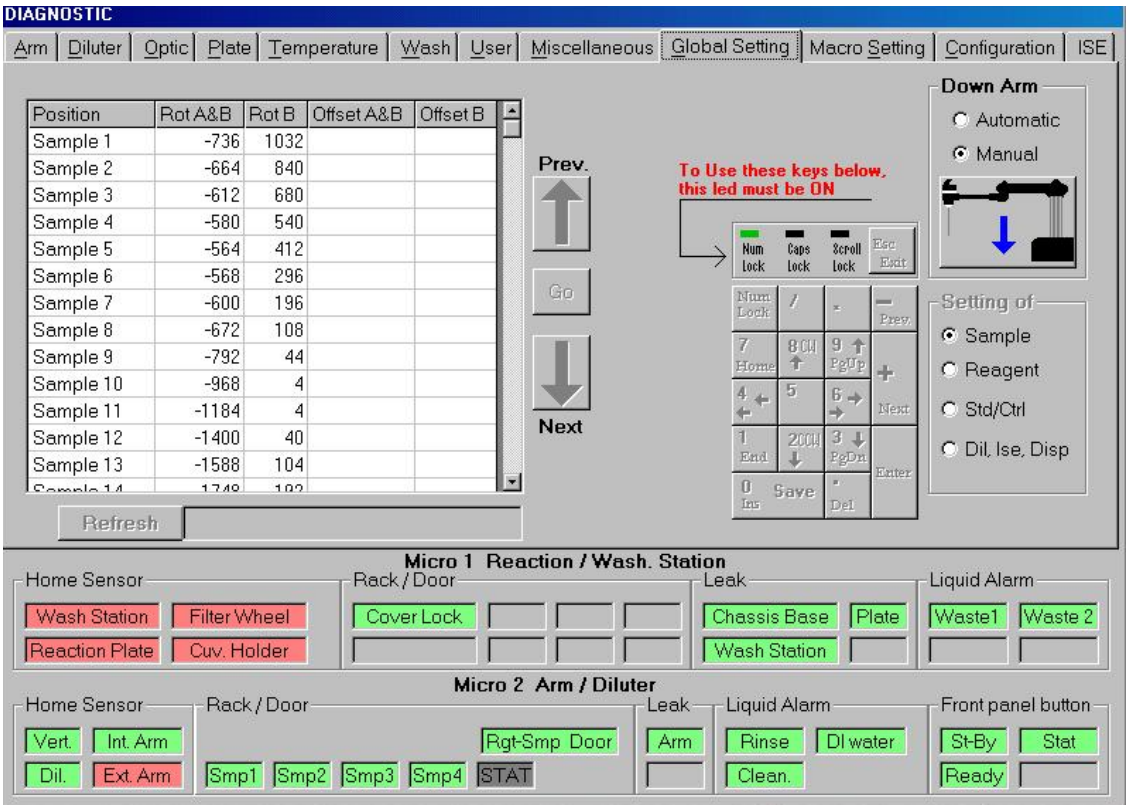
Sensor Polling: To choose either Polling ON or Polling OFF. When in the Polling ON position, it is possible to check the functionality of the optical filters in various positions.

5.10.6 STATUS COMMAND AREA

Send: Visualizes the commands sent by the program to the instrument hardware

Receive: Visualizes the instrument hardware's response to the commands.

5.11 “GLOBAL SETTING” FOLDER



Warning: the improper use of the functions described in this folder can damage the sampling probe.

The Global Setting Folder is subdivided into four areas:

- **TABLE POSITION**
- **KEYBOARD**
- **DOWN ARM**
- **SETTING OF**

5.11.1 TABLE POSITION

This table has five columns:

Position: Lists all the possible instrument positions (samples, reagents, standard, controls, diluents, ISE, dispense);

Rot A&B: Gives the base steps for the complete arm (internal and external) in every position;

Rot B: Gives the base steps only for the external arm in every position;

Offset A&B: Gives the corrective steps necessary for the arm's adjustment (internal and external);

Offset B: Gives the corrective steps necessary for the external arm's adjustment.

Next to the Sample Table there are 3 commands:

Prev: Returns the arm to the previous position;

Next: Brings the arm to the successive position;

Go: Brings the arm to the first position according to the category selected in the area "Setting of" (Sample, reagent, Std/Ctrl, Dil, Ise, Disp).

5.11.2 KEYBOARD

The various positions can be improved through the keyboard, saving the operations performed.

The areas visible in Fig.6 may be activated by the mouse or with the help of the numerical buttons on the keyboard. The buttons are listed with their corresponding function:

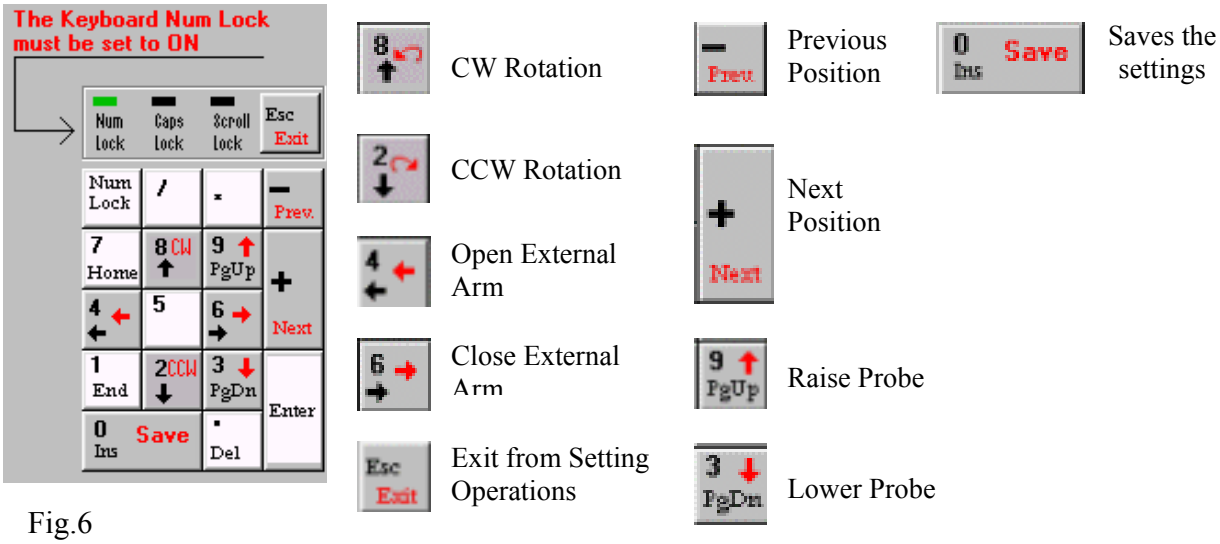


Fig.6

5.11.3 DOWN ARM

This area has the option to decide if the arm, once set in a determined position, should automatically command the probe to go down or wait for the manual command.

5.11.4 SETTING OF

This area has a selection of location categories that are used to set the functions (Sample, reagent, Std/Ctrl, Dil, Ise, Disp).

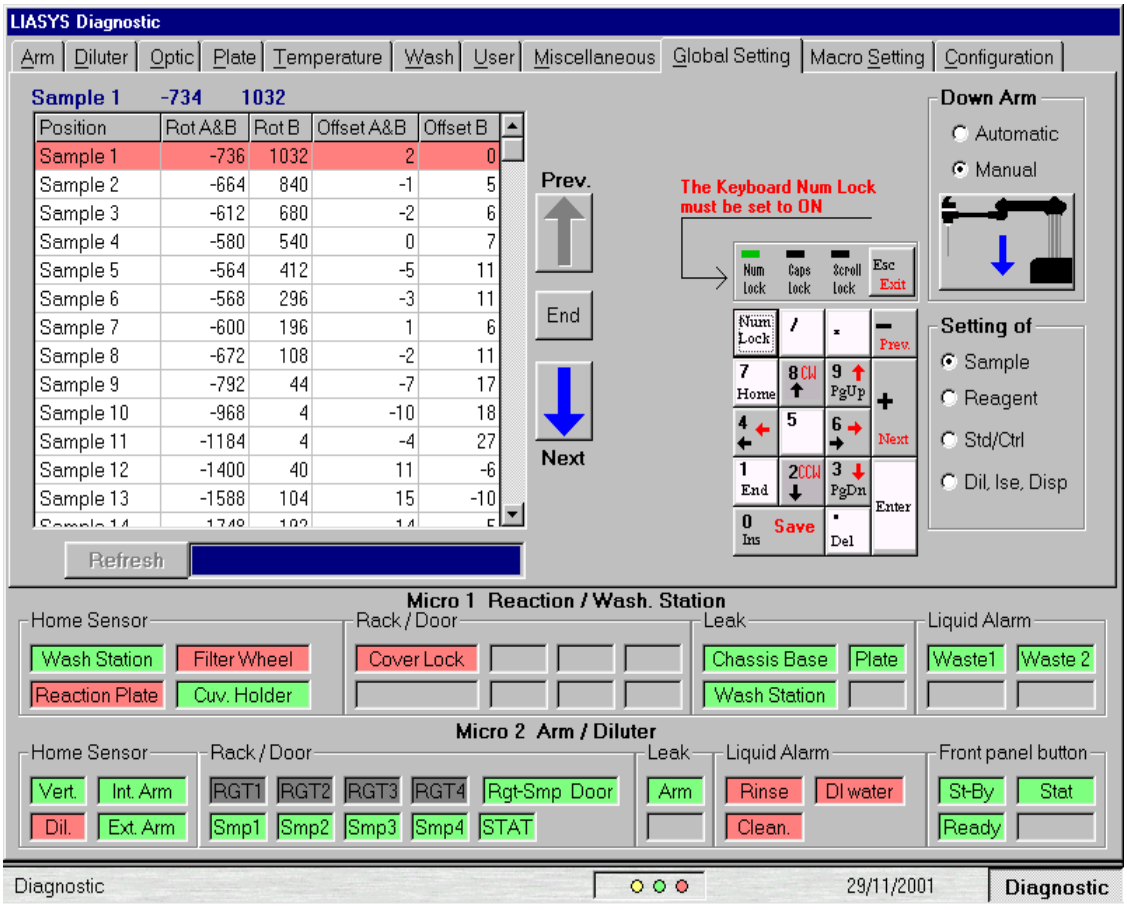
Setting Procedure

⇒ Choose the position category in the "Setting of" Area;

⇒ Click with the left side of the mouse on the Go area (as soon as the area is clicked on it changes to End);

⇒ The Liasys resets the arm, and the values of the Offset column appear on the table (Fig.7);

Fig.7



⇒ The arm centering can be adjusted at the highlighted area by giving commands through the keyboard or mouse:

8 = CW Rotation
2 = CCW Rotation
4 = Open External Arm
6 = Close External Arm
+ = Next Position
- = Previous Position

⇒ Repeat the centering for all the relevant positions;

⇒ Push the Save button to save the operations performed;

⇒ Wait for the arm to automatically reset.

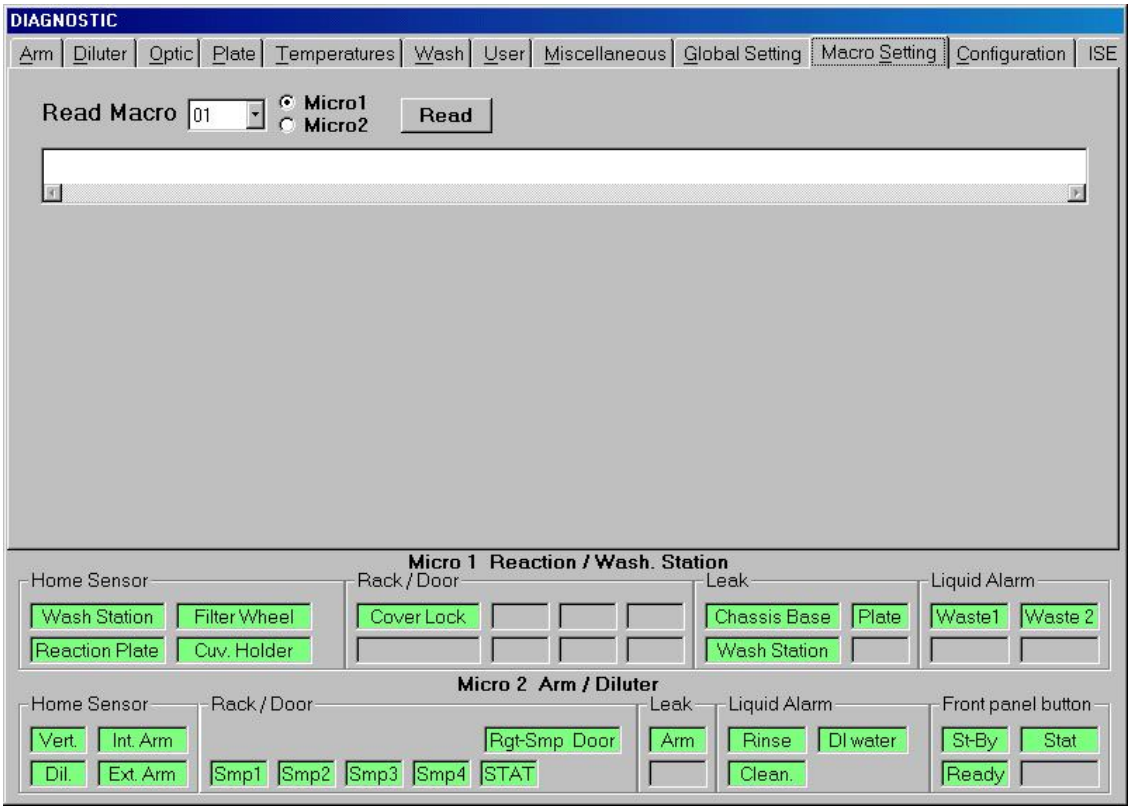
NOTE: If the option Manual (default) is chosen in the Down Arm area, to make the arm go up and down it is possible to use either the buttons pgUp and pgDn or click with the mouse on the button with the arm figure in the Down Arm Area.

WARNING:

THE FIRST TIME THAT THE SETTING PROCEDURE IS PERFORMED, IT IS EXTREMELY IMPORTANT TO CHOOSE THE MANUAL OPTION IN THE DOWN ARM AREA.

BY CHOOSING THE "AUTOMATIC" OPTION THERE IS A CONSIDERABLE RISK OF BREAKING THE PROBE DUE TO POSITIONS THAT HAVE NOT BEEN PROPERLY CENTERED.

5.12 “MACRO SETTING” FOLDER



This folder allows the user to read the macro present in the Liasys.

To read the macro follow the below procedure:

⇒ Select the micro from which the information will be asked;

⇒ Select from the menu sheet “Read Macro” the number of relevant macro;

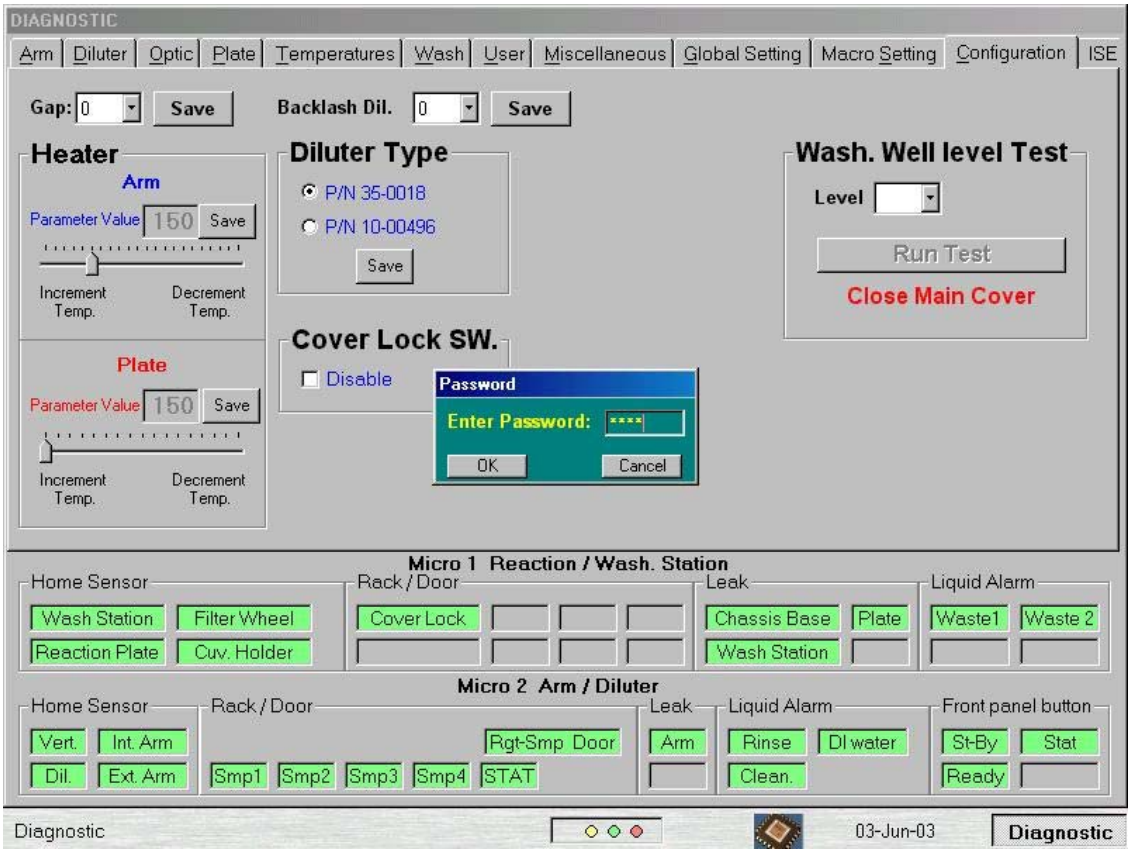
⇒ Click with the left side of the mouse on the Read area;

⇒ If the Macro requested exists, the information will appear in the designated area.

5.13 "CONFIGURATION" FOLDER

This folder may be accessed only by qualified technical assistant.

It is necessary for the technical assistant to insert a password to access this folder.



The Configuration Folder is subdivided into six areas:

- **Gap**
- **Backlash Dil.**
- **Heater**
- **Diluter Type**
- **Cover Lock SW.**
- **Wash. Well level Test**

Gap: defines the volume, in µL, of the air bubble that separates the Rinse (the liquid column into the sampling arm tube) from the sampled reagent; this volume must be set in the range from 10 to 24 (Standard value 16).

For the correct setting of the gap volume it is necessary to apply the procedure of BIB (Precision check of the Analytical plate) and BIC (Volume precision check of the Sampling line).

If BIC's CV values should exceed the limit specified below, the GAP has to be increased by steps of 2 µL (starting from 10 µL) until obtaining the expected BIC's CV value

Precision check of the Analytical plate BIB

Prepare two series of 32 samples each by using a diluted solution of **K2Cr2O7** (obtained from 4 gr/l concentrated solution diluted 1:100 with Rinse solution (distilled water + 1000 µL/litre of Brij))

Use the same solution as samples and reagent

Program a new method with the following parameters:

Method name: **BIB**

Type: **End Point**

Sample volume **K2Cr2O7 0,04 gr/l**	3 µL
Reagent volume **K2Cr2O7 0,04 gr/l**	300 µL
Rinse volume	20 µL
Filter:	340 nm
Incubation time:	116 sec
Calculation factor:	1000

BIB Procedure

1. Select conical cup in **Options**
2. Program the BIB method using the above parameters and configure a reagent rack containing it
3. Enter in the calibration screen and select RBL for BIB method.
4. Put the Rinse solution as reagent and standard (fourteenth position of the Crt/Std rack) and Start the Calibration
5. Program 64 BIB; fill 32 conical samples cup with **K2Cr2O7 0,04 gr/l**
6. Load the samples racks into the Analyzer at positions 1 and 2
7. Substitute the Rinse Solution with **K2Cr2O7 0,04 gr/l** in the reagent rack
8. Start the Analyzer. At the end of the last sampling, move the samples racks to positions 3 and 4.

The mean of the reading obtained from each of the 32 sample series must fall within **360 ÷ 400.**
The coefficient of variation (CV %) must be lower than **0.7 %** for each series of 32 samples.

Precision check of the Sampling volume BIC

Prepare two series of 32 samples each by using **$K_2Cr_2O_7$ 4 gr/l** (concentrated)
Use the same solution for both samples and reagent
Program a new method with the following parameters:
Method name: **BIC**
Type: **End Point**

Sample volume **$K_2Cr_2O_7$ 4 gr/l**	3 µL
Reagent volume RINSE Solution (distilled water + 1000 µL/litre of Brij)	300 µL
Filter:	340 nm
Incubation time:	116 sec
Calculation factor:	1000

BIC Procedure

1. Program the BIC method using the above parameters and configure a reagent rack
2. Enter in the Calibration screen and select RBL for BIC method.
3. Put the Rinse Solution as reagent and Standard (fourteenth position of the Crt/Std rack) and Start the Calibration
4. Program 64 BIC ; fill 32 conical samples cup with **$K_2Cr_2O_7$ 4 gr/l** (concentrated)
5. Load the samples racks into the Analyzer at positions 1 and 2
6. Start the Analyzer. At the end of the last sampling, move the sample racks to positions 3 and 4.

The mean of the readings obtained from each of the 32 sample series must fall between **350 ÷ 450**.
The coefficient of variation (CV %) must be lower than **1.6 %** for each series of 32 samples

If BIC's CV values should exceed the limit specified above, the GAP has to be increased by steps of 2 µL (starting from 10 µL) until obtaining the expected BIC's CV value

Backlash Dil.: Allows to recover the sampling imprecision generated by the motor when it inverts its rotation; the setting is expressed in µL and obtained by using the following procedure:

1. Enter in the Diagnostic Arm folder menu and make the Sampling Arm "Reset"
2. Enter in the **Diluter** folder, press the "HOME" button and then Push "PROBE WASH TEST" button three times in order to fill the hydraulic sampling line
3. Remove the plastic cover of the sample racks vane and take out the samples racks
4. Enter in the **ARM** folder and push the "GO" button in order to move the probe to sample position # 1
5. Put a sample cup containing distilled water (about 1ml) under the sampling probe
6. Enter in the **DILUTER** folder and aspirate 300 µL of distilled water from the cup
7. Remove the sample cup containing distilled water
8. Select 1 µL to dispense and press the "Disp" key repeatedly until water appears on the tip of the probe.
9. Substract 1 from the number of times you pressed the "Disp" key. The obtained number has to be introduced as BACKLASH value
10. Push the **Save** button to memorize the inserted data
11. Push the **Reset** button into the ARM folder
12. Close the Diagnostic program by clicking on the Diagnostic button

Heater: to adjust the preheater and reaction plate temperatures;

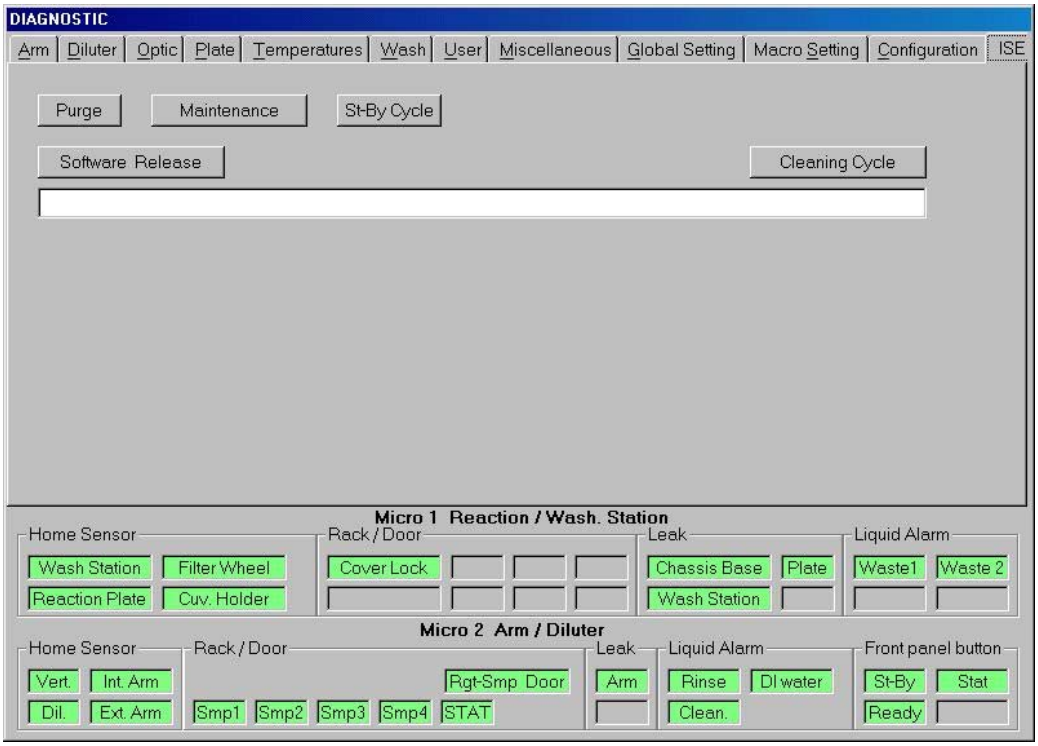
Diluter Type: to select the kind of diluter to be used. Each kind of diluter has a dedicated ratio (# steps/µL);

Cover Lock SW.: to disable the automatic check of the correct closure of the Liasys cover;

Wash. Well level Test: By clicking on the "Run Test" button the system performs an automatic verification and adjustment cycle for the liquid level in the washing well.
A number appears in the box "Level" that corresponds to the rotation time of the rinse pump in milliseconds, that is necessary to maintain the correct liquid level in the washing well.

The functioning range is between 400 and 700 milliseconds. If the washing well is not sufficiently filled, a message appears to warn the user to check the hydraulic line.
If the value taken during the test is different from the previous one, it is necessary to click on "Save" in order to save the new data.

5.14 "ISE" Folder



This folder permits checks and maintenance activity on the ISE

Purge: fills the hydraulic ISE Module line

Maintenance: empties the electrodes line for their replacement

St-By Cycle: performs a prime cycle to renew the Calibrant A solution in the electrode line

Software Release: visualizes the ISE Module Firmware release

Cleaning Cycle: performs an electrode washing cycle

CHAPTER 06

- SETTINGS AND ADJUSTMENTS -

INDEX

6 SETTINGS AND ADJUSTMENTS 4

6.1 SAMPLING ARM 4

6.1.1 ALIGNMENT AND ADJUSTMENTS 4

6.1.2 SUBSTITUTION OF THE SAMPLING ARM 6

6.1.3 SUBSTITUTION OF THE OPTIC SENSORS 7

6.1.3.1 SUBSTITUTION OF THE OS7 OPTIC SENSOR 7

6.1.3.2 SUBSTITUTION OF THE OS6 AND OS5 OPTO SENSORS 9

6.1.3.2a SUBSTITUTION OF THE OS6 OPTO SENSOR 10

6.1.3.2b SUBSTITUTION OF THE OS5 OPT-COUPLER 11

6.1.4 SAMPLING ARM MOTORS 12

6.1.4.1 SUBSTITUTION OF THE M7 MOTOR 13

6.1.4.2 SUBSTITUTION OF THE M6 MOTOR 17

6.1.4.3 SUBSTITUTION OF THE M5 MOTOR 19

6.1.5 PRE-HEATER AND LEVEL SENSOR 21

6.1.5.1 SUBSTITUTION OF THE PRE-HEATER AND LEVEL SENSOR ASSEMBLY 21

6.1.5.2 LEVEL SENSOR FUNCTIONING CHECK 25

6.1.6 DILUTER MODULE 27

6.1.6.1 SUBSTITUTION OF THE DILUTER MODULE 27

6.1.6.2 SUBSTITUTION OF THE DILUTER MICRO-PUMP 27

6.1.6.3 SUBSTITUTION OF THE DILUTER ELECTRO-VALVE....28

6.1.6.4 DILUTER MODULE - CHECK PROCEDURE FOR MECHANICAL FUNCTIONING ……. 28

6.2 OPTIC ASSEMBLY 30

6.2.1 SUBSTITUTION OPTIC ASSEMBLY 30

6.2.2 SUBSTITUTION OF THE PHOTOMETER LAMP....32

6.2.3 ELECTRONIC ADJUSTMENT OF THE PHOTOMETER 33

6.2.4 SUBSTITUTION OF THE OPTO SENSOR....35

6.2.5 SUBSTITUTION OF THE MOTOR 36

6.2.6 SUBSTITUTION OF THE OPTIC FILTERS 37

6.3 PUMP ASSEMBLY 38

6.3.1 SUBSTITUTION OF THE PUMP ASSEMBLY 38

6.3.2 SUBSTITUTION OF THE PERISTALTIC PUMP MOTOR 39

6.3.2.1 FUNCTION CHECK FOR THE PERISTALTIC PUMP....40

6.3.3 SUBSTITUTION OF PART(S) 40

6.3.4 MECHANICAL ADJUSTMENT OF THE PERISTALTIC PUMP 41

6.3.4.1 HOW TO SUBSTITUTE PERISTALTIC PUMP TUBES....42

6.4 REACTION PLATE 43

6.4.1 REACTION PLATE - MECHANICAL ADJUSTMENT 43

6.4.2 SUBSTITUTION OF THE REACTION PLATE....44

6.4.3 SUBSTITUTION OF THE OS3 OPTIC SENSOR....45

6.4.4 SUBSTITUTION OF THE M3 MOTOR....47

6.5 WASHING STATION ASSEMBLY....49

6.5.1 SUBSTITUTION OF THE WASHING STATION ASSEMBLY 49

6.5.2 SUBSTITUTION OF THE WASHING STATION OPTIC SENSOR....51

6.5.3 SUBSTITUTION OF THE WASHING STATION MOTOR....51

6.5.4 WASHING STATION - MECHANICAL ADJUSTMENT AND FUNCTIONAL CHECK…….....52

6.5.4.1 WASHING STATION - HORIZONTAL ALIGNMENT....52

6.5.4.2 WASHING STATION - VERTICAL ALIGNMENT....53

6.5.4.3 WASHING STATION - FUNCTIONAL CHECK....53

6.5.5 WASHING STATION - CUVETTE HOLDER ASSEMBLY....54

6.5.5.1 SUBSTITUTION OF THE CUVETTE HOLDER ASSEMBLY MAGNET....54

6.5.5.2 SUBSTITUTION OF THE CUVETTE HOLDER ASSEMBLY OPTO SENSOR....54

6.5.5.3 ADJUSTMENT AND FUNCTIONAL CHECK OF THE CUVETTE HOLDER MAGNETIC TRIGGER....55

6.6 TEMPERATURE CHECK AND ADJUSTMENT....57

6.6.1 REACTION CUVETTE TEMPERATURE ADJUSTMENT AND CHECK....57

6.6.2 TEMPERATURE CHECK AND ADJUSTMENT USING KIT P/N 55-01204-00....58

6.6.3 REFRIGERATION ASSEMBLY TEMPERATURE CHECK....67

6.7 RACKS HOLDER ALIGNMENT....68

6.7.1 MECHANICAL ALIGNMENT OF THE SAMPLES RACKS HOLDER....68

6.7.2 MECHANICAL ALIGNMENT OF THE REAGENTS RACKS HOLDER....69

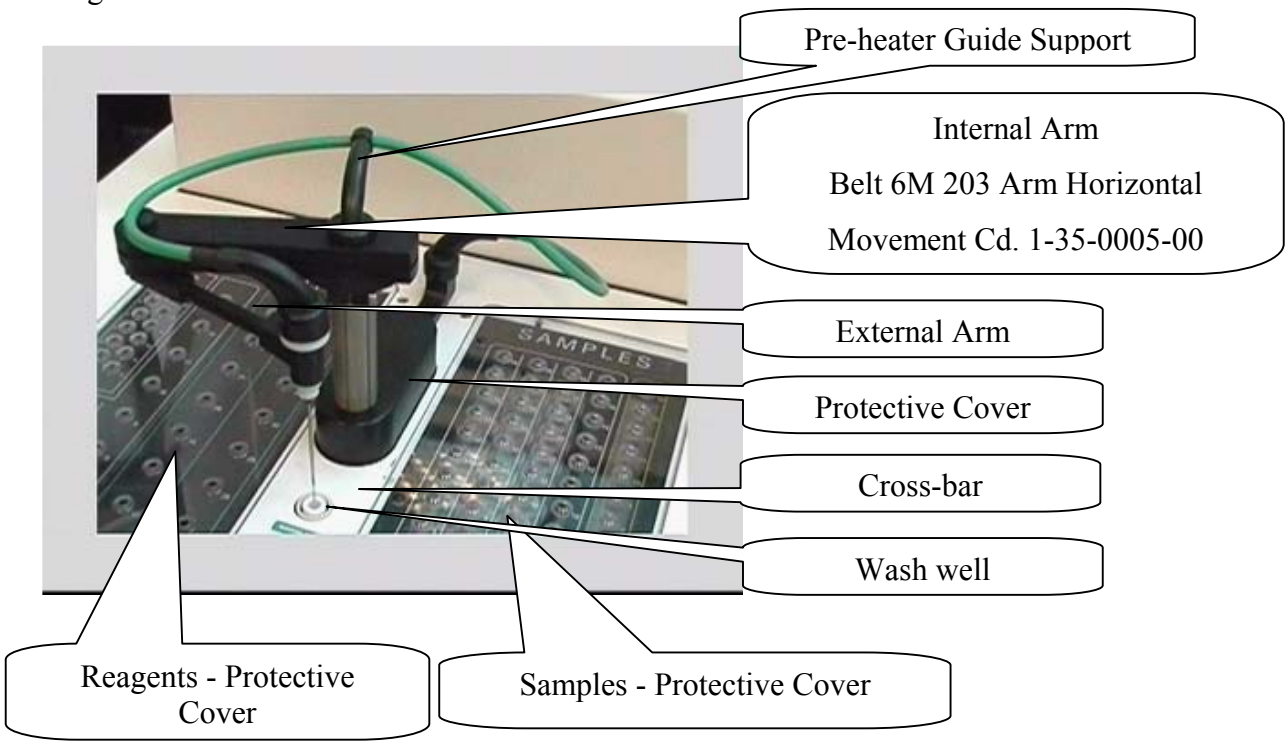
6 SETTINGS AND ADJUSTMENTS

6.1 SAMPLING ARM

6.1.1 ALIGNMENT AND ADJUSTMENTS

1. Turn on the Liasys system (instrument and computer).
2. Launch the Diagnostic program, select "Global Setting". Wait until the instrument has completed the reset procedure.
3. Make sure that all the "home sensors" of the Sampling Arm (Vert., Int. Arm and Ext. Arm) light up green.
4. Make sure that the probe is centered with respect to the wash well. If not, loosen the fastening screws on the external arm and mechanically align the arm on the wash well, paying attention to center the probe with respect to the wash well. If absolutely necessary, also the internal arm can be adjusted - loosen only one of its fastening screws.

Fig.1

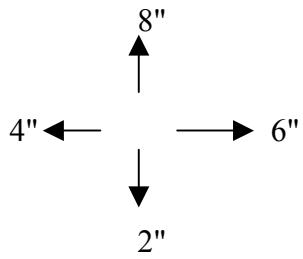


5. Tighten the External Arm fastening screws and, if necessary, those of the Internal Arm, centering the probe with respect to the wash well.
6. Perform a complete Arm reset in order to ascertain correct centering of the probe on the wash well. If the centering is not exact, repeat steps 4 and 5.
7. After having mechanically centered the sampling probe on the wash well, adjust all the other positions by using the computer's numeric keyboard as follows:

N.B.: make sure that the distance between the top edge of the wash well and the tip of the probe is "2.0 +/- 0.5 mm"

Use the following keys to make the necessary adjustments.

- To move the arm horizontally



- <Next / + > to move forward one position
- <Prev / - > to move back one position
- <9> to move upward
- <3> to move downward

8. Select "Sample" from "Setting of" and then press the "Go" key. The arm will automatically move itself to position #1 of the Samples rack. Adjust the positioning by using the keys indicated for centering the probe with respect to the hole in the Samples Cover.
9. Move on to the next position by pressing the "Next/+" key and center the probe, as above.
10. Make sure that when adjusting position #16, mechanical end-of-run of the arm does not occur. If this should happen, repeat the mechanical alignment of the sampling probe with respect to the wash well and repeat the procedure from step 4.
11. Press "Save" to memorize the new positions' settings.

12. Select "Reagent" from "Setting of" and then press the "Go" key. The arm will automatically move itself to position #1 of the Reagents rack.
    Adjust the positioning by using the keys indicated for centering the probe with respect to the hole in the Reagents Cover.
13. Move on to the next position by pressing the "Next/+" key and center the probe, as above.
14. Make sure that when adjusting position #33, mechanical end-of-run of the arm does not occur. If this should happen, repeat the mechanical alignment of the sampling probe with respect to the wash well and repeat the procedure from step 4.
15. Press "Save" to memorize the new position settings.
16. Set the positioning of Std/Ctrl and Dil, Ise, Disp. Press "Save" to memorize the new position settings.
17. To exit the diagnostic program, press the "Diagnostic" key
18. To exit the analyzer program press “shutdown” key..

6.1.2 SUBSTITUTION OF THE SAMPLING ARM

N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure.

1. Remove the sampling probe from its housing.
2. Remove the samples and reagents racks' protective covers.
3. Remove the samples rack and reagents rack.
4. Unscrew the four cross bar fastening screws. Remove the cross bar by slipping out the Pre-heater guide support (Fig.1).
5. Remove the waste tube from the wash well.
6. Remove the teflon tube from the diluter head by unscrewing the fastening washer, paying special attention to leakage of liquid.
7. Unscrew the four anchored screws indicated in Fig. 5, unplug the J1, J2, J6, J8, J13, J15 and J17 connectors from the Sampling Interface assy. Disconnect the ground wire and following the procedure provided in section 6.1.5.1 remove the Level Sensor and Pre-Heater assembly.

8. Take out the sampling arm and substitute it with the new one.
9. To remount, repeat the above steps in inverse order: from 7 to 1.

Warning: After having substituted the sampling arm, it is necessary to mechanically align the probe with respect to the wash well and center all the other positions by following the procedures provided in Section 6.1.1 "Alignment and Adjustments".

6.1.3 SUBSTITUTION OF THE OPTIC SENSORS

6.1.3.1 Substitution of the OS7 Optic sensor

1. Remove the sampling probe from its housing.
2. Remove the samples and reagents racks' protective covers.
3. Remove the samples rack and reagents rack.
4. Unscrew the four cross bar fastening screws. Remove the cross bar by slipping out the Pre-heater guide support (Fig.1).
5. Loosen the protective cover's set screw (Fig.2) and lift it.
6. Remove the fastening screws from the optic sensor support, unplug the J11 connector from the Sampling Interface assy and take out the entire assembly (Fig.3).
7. Remove the fastening screws from the optic sensor itself and substitute it with the new one.
8. To remount, repeat above steps in inverse order: from 7 to 1.

N.B.: when remounting the optic sensor, make sure to center it with respect to the slots, as shown in Fig. 4.

N.B.: due to the fact that it may be necessary to further adjust the positioning of the optic sensor, screw down the cross bar and the protective cover only after having made sure that the sampling arm functions correctly by carrying out the procedure described in Section 6.1.1

Warning: Do not tighten the protective cover's set screw as this could result in mechanical malfunction of the sampling arm's vertical movement (Fig. 2).

Warning: After having substituted the optic sensor, it is necessary to mechanically align the probe with respect to the wash well and center all the other positions by following the procedures provided in Section 6.1.1 "Alignment and Adjustments".

N.B.: the following check is valid only for the OS7 optic sensor

Verification of the correct positioning of the OS7 optic sensor

Set the Samples position at #16. If it is not possible to obtain an exact centering (due to mechanical end-of-run), move the OS7 optic sensor to the left. After having mechanically aligned the optic sensor, center all the other positions by following the procedures provided in Section 6.1.1

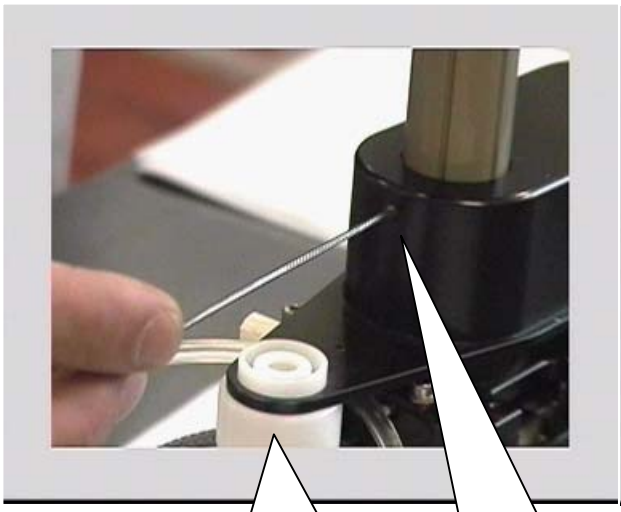


Fig. 2

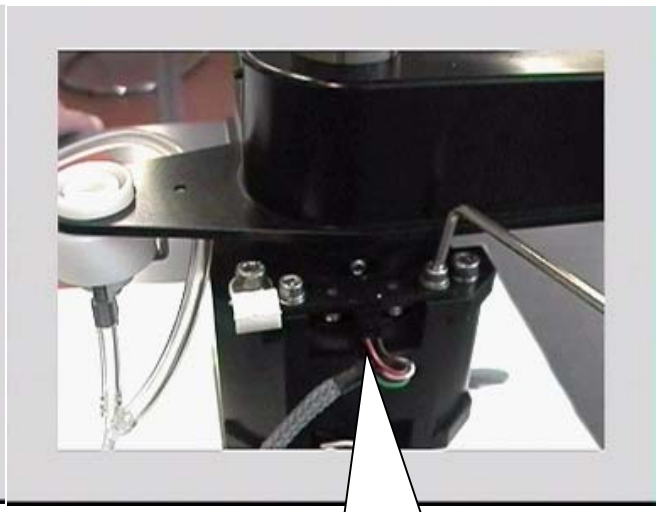


Fig. 3

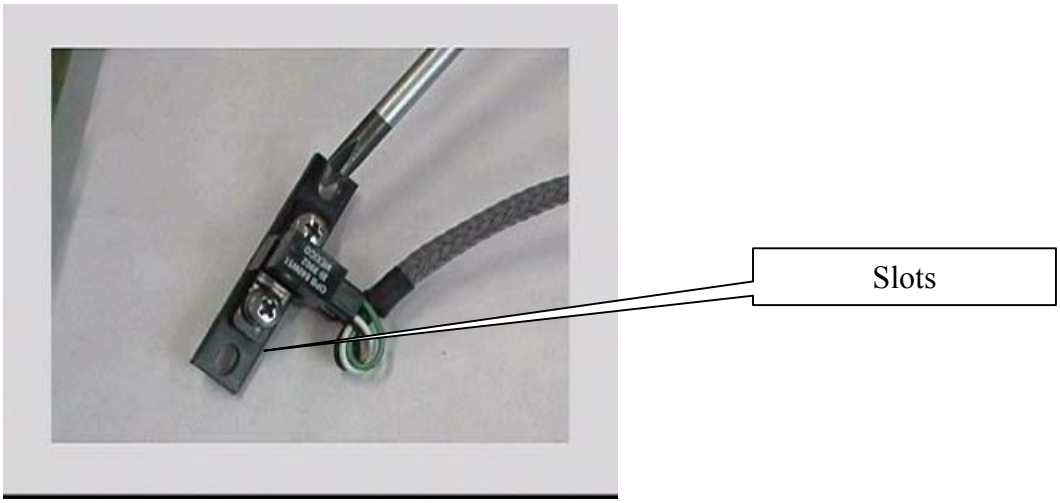


Fig. 4

6.1.3.2 Substitution of the OS6 and OS5 Opto sensors

N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure.

In order to arrive at the OS6 and OS5 Opto sensors, it is necessary to remove the arm assembly from its housing. Unplug connectors J9 and J10 from the Sampling Interface assy; disconnect the wash well hydraulic tube and the teflon tube on the diluter. Loosen the four anchored screws. When removing the sampling arm, be extremely careful to not damage the pre-heater.

The following steps, from 1 to 6, are to be carried out regardless of which opto sensor is being substituted (OS6 or OS5).

1. Remove the sampling probe from its housing.
2. Remove the samples and reagents racks' protective covers (Fig.1).
3. Remove the samples rack and reagents rack.
4. Unscrew the four cross bar fastening screws. Remove the cross bar by slipping out the Pre-heater guide support (Fig.1).
5. Remove the waste tube from the wash well and the teflon tube on the diluter.
6. Unscrew the four anchored screws indicated in (Fig.5), unplug the J1, J2, J15 and J17 connectors from the Sampling Interface assy (Fig.5). Disconnect the ground wire and remove the sampling arm.

6.1.3.2 a Substitution of the OS6 Opto sensor

a) Remove the screws which fasten the opto sensor support and take out the entire assembly (Fig.6).

b) Unplug the J10 connector from the Sampling Interface assy, remove the opto sensor fastening screws and substitute it with the new one.

c) To remount, repeat the above steps in inverse order: from b) to a) and then from 6 to1 in Section 6.1.3.2

Warning: Do not tighten the protective cover's set screw as this could result in mechanical malfunction of the sampling arm's vertical movement (Fig.2).

N.B.: when remounting the opto sensor, make sure to center it with respect to the slots, as shown in Fig. 4.

Warning: After having substituted the opto sensor, it is necessary to mechanically align the probe with respect to the wash well and center all the other positions by following the procedures provided in Section 6.1.1 "Alignment and Adjustments".

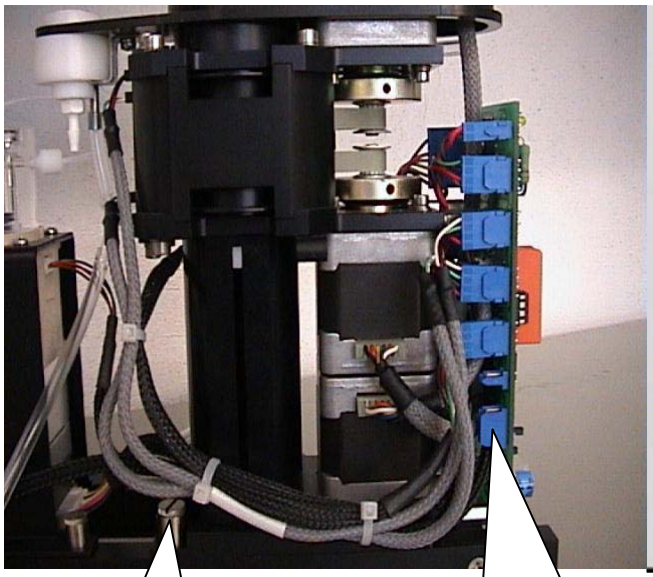


Fig. 5

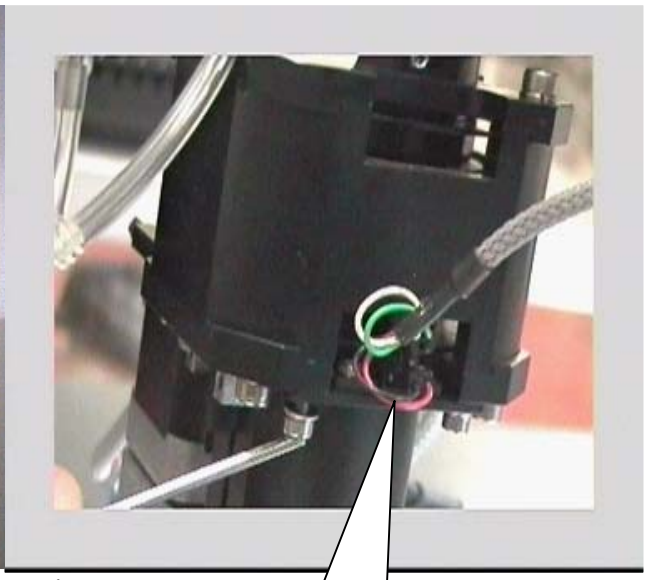


Fig. 6

Anchored screws

Sampling Interface Assy Cd.30-00192-01

OS6 Opto coupler assy Cd. 9-10-0023-00

6.1.3.2 b Substitution of the OS5 Opt-coupler

a) Carry out Steps 1 through 6 as indicated in Section 6.1.3 "Substitution of the OS6 and OS5 Opto sensors.

b) Remove the screws which fasten the opto sensor support and take out the entire assembly (Fig.7).

c) Unplug the J9 connector from the Sampling Interface assy, remove the optic sensor fastening screws and substitute it with the new one.

d) Pay particular attention to the spacer washers placed between the opto sensor and the support (Fig.8)

e) To remount, repeat the above steps in reverse order: from c) to a) and then from 6 to1 in Section 6.1.3.2

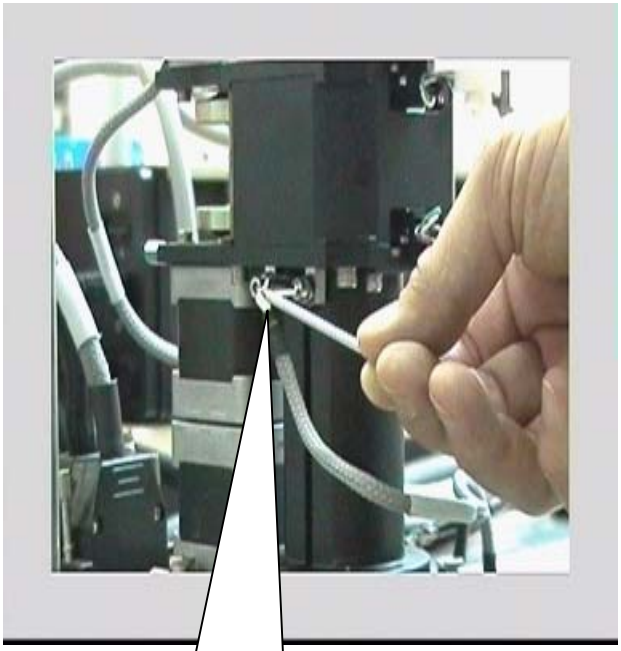


Fig. 7

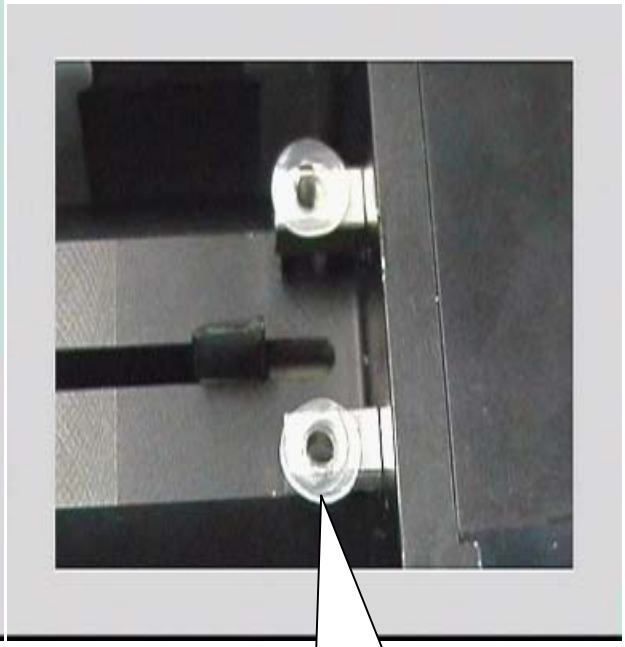


Fig. 8

Warning: Do not tighten the protective cover's set screw as this could result in mechanical malfunction of the sampling arm's vertical movement (Fig. 2).

N.B.: make sure that the distance between the top edge of the wash well and the tip of the probe is "2.0 +/- 0.5 mm"

Warning: After having substituted the opto sensor, it is necessary to mechanically align the probe with respect to the wash well and center all the other positions by following the procedures provided in Section 6.1.1 "Alignment and Adjustments".

6.1.4 SAMPLING ARM MOTORS

N.B.: Make sure the instrument (Liasys) is turned off before performing this procedure.

Important: pay special attention to the Pre-heater when removing or servicing the sampling arm.

In order to arrive at the M7, M6 and M5 motors, it is necessary to remove the sampling arm assembly from its housing; unplug the J1, J2, J3, J4, J5, J15 and J17 connectors from the Sampling Interface assy; disconnect the hydraulic tube from the wash well and the teflon tube on the diluter; remove the four anchored fastening screws from the assembly.

6.1.4.1 Substitution of the M7 motor

1. Remove the sampling probe
2. Remove the samples and reagents racks' protective covers.
3. Remove the samples rack and reagents rack.
4. Unscrew the four cross bar fastening screws. Remove the cross bar by slipping out the Pre-heater guide support (Fig.1).
5. Remove the waste tube from the wash well.
6. Remove the teflon tube on the diluter head by unscrewing the fastening washer - pay particular attention to leakage of liquid.
7. Unscrew the four anchored screws indicated in Fig. 3; unplug the J1, J2, J4, J15 and J17 connectors from the Sampling Interface assy; unplug the ground wire; remove the sampling arm.
8. Loosen the fastening screw and lift the sampling arm's protective cover (Fig.4), in order to arrive at the M7 motor.
9. Remove the M7 motor fastening screws (Fig 5).
10. Loosen the motor pulley screws (Fig.6).
11. Take out the M7 motor and substitute it with the new one.(Fig.7).
12. Lift the pulley to approximately 0.5mm from its upper limit and tighten its screws(Fig.8).
13. Push the M7 motor outward, as shown in (Fig.9), and holding it in this position, so as to maintain the belt in tension, tighten the motor fastening screws.
14. To remount, repeat the above steps in inverse order: from 8 to 1.

Warning: Do not tighten the protective cover's set screw as this could result in mechanical malfunction of the sampling arm's vertical movement (Fig. 2).

Warning: After having substituted the motor, it is necessary to mechanically align the probe with respect to the wash well and center all the other positions by following the procedures provided in Section 6.1.1 "Alignment and Adjustments".

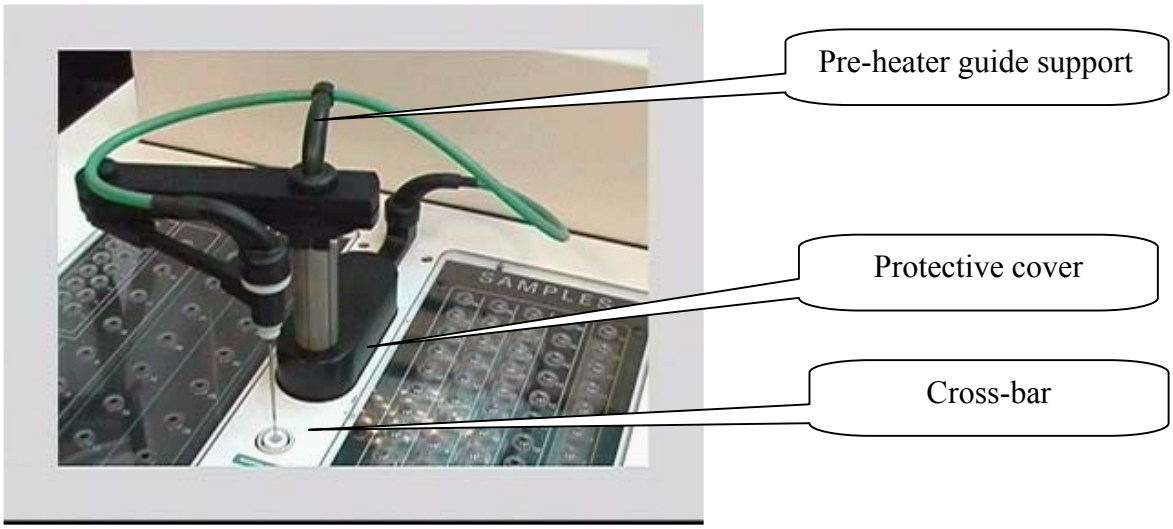


Fig.1

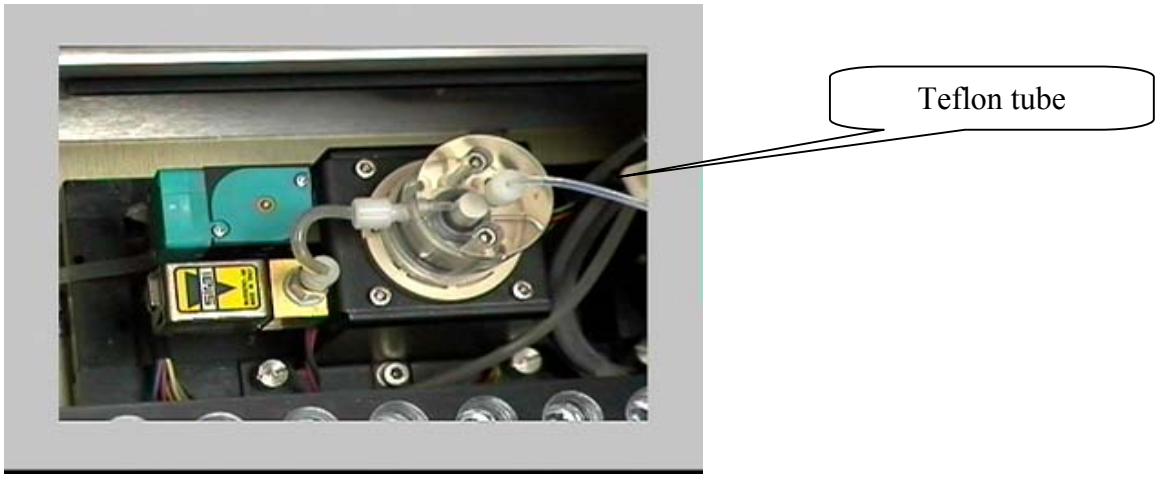


Fig. 2 Dilutor Module

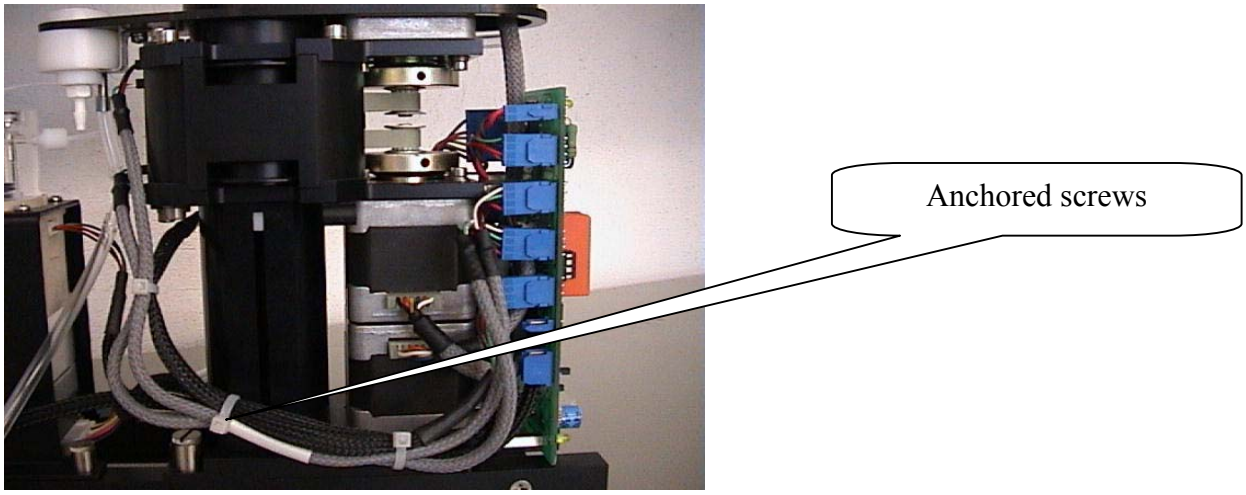


Fig. 3 Arm assembly without base and Sampling Interface Board Cd. 9-15-0020-00

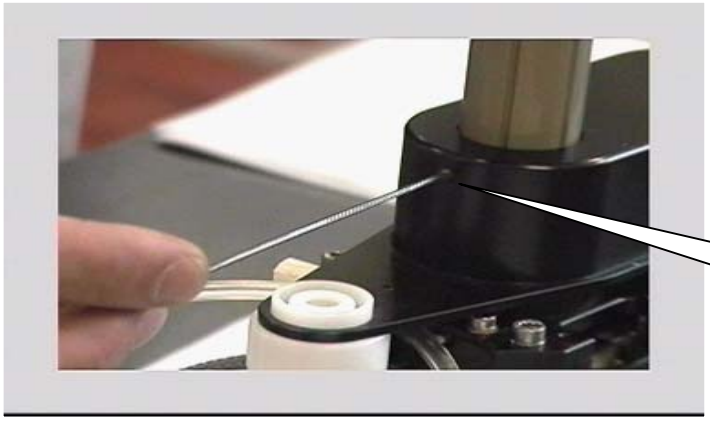


Fig. 4

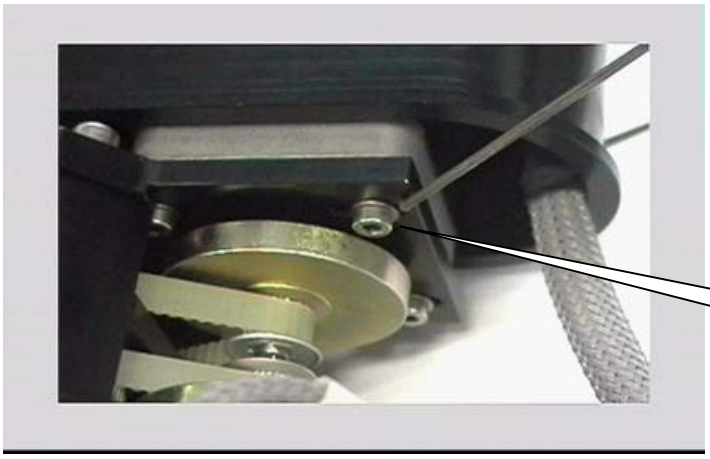


Fig. 5

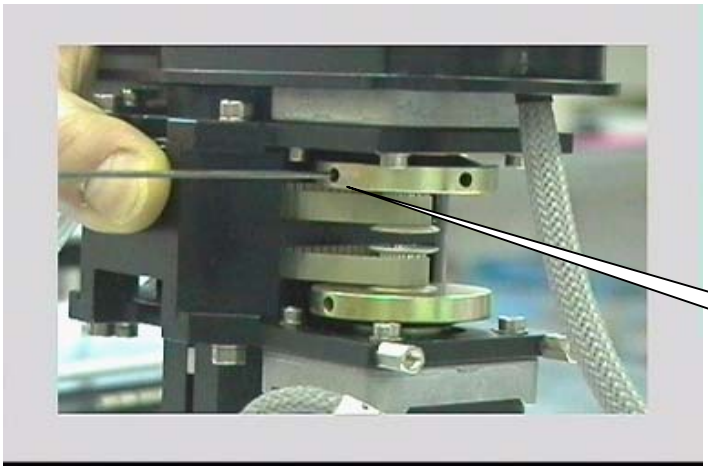


Fig. 6

Fig. 7

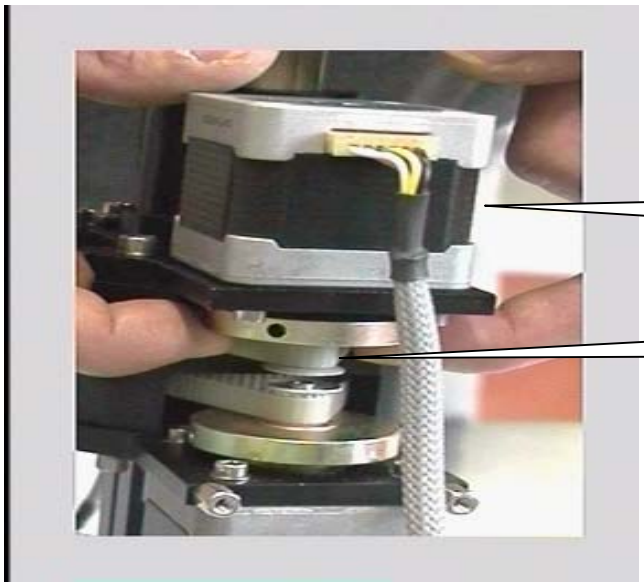


Fig. 8

Fig. 9

6.1.4.2 Substitution of the M6 Motor

N.B.: Make sure the instrument (Liasys) is turned off before performing this procedure.

Important: pay special attention to the Pre-heater when removing or servicing the sampling arm.

1. Remove the sampling probe.
2. Remove the samples and reagents racks' protective covers.
3. Remove the samples rack and reagents rack.
4. Unscrew the four cross bar fastening screws. Remove the cross bar by slipping out the Pre-heater guide support (Fig.1).
5. Remove the waste tube from the wash well.
6. Remove the teflon tube on the diluter head by unscrewing the fastening washer (Fig.2), paying special attention to leakage of liquid.
7. Unscrew the four anchored screws indicated in (Fig.3); unplug the J1, J2, J5, J15 and J17 connectors from the Sampling Interface assy; unplug the ground wire; remove the sampling arm.
8. Take the Sampling Interface assy out by unplugging the connectors and unscrewing the fastening screws (Fig.10).

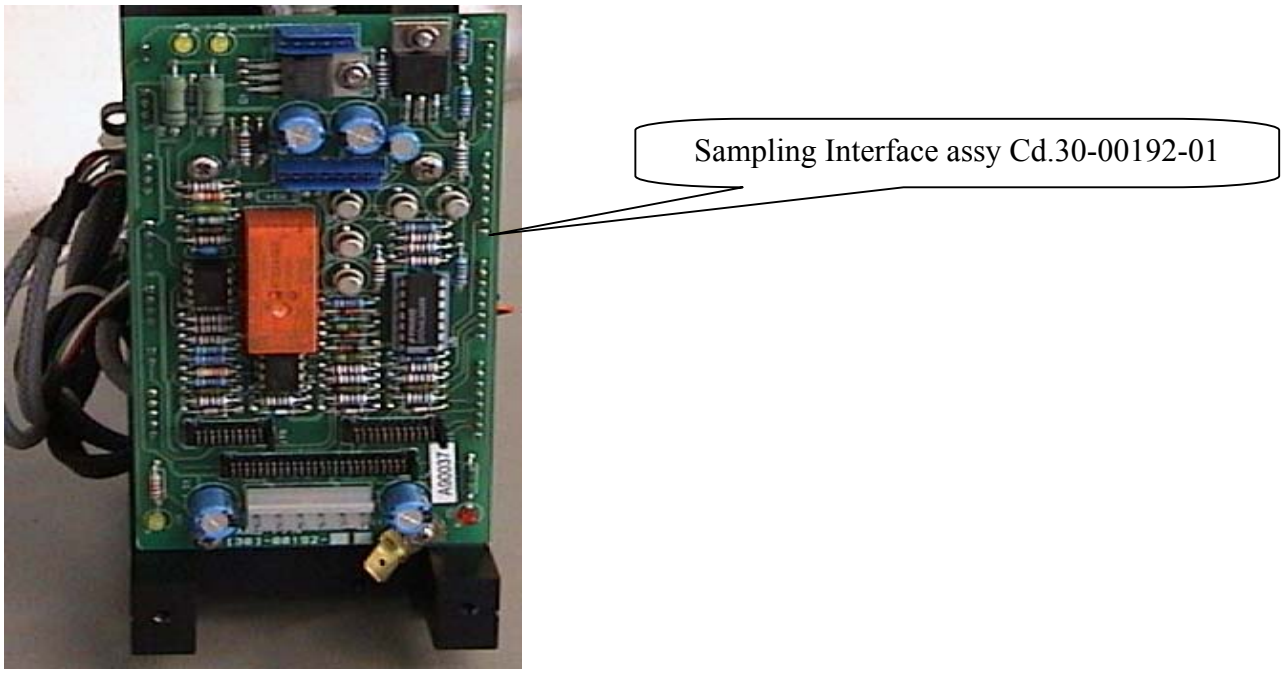


Fig.10

N.B.: In order to be able to remove the M6 motor from its support, it is necessary to first partially disassemble the module as shown in Fig.12.

9. Unscrew the three fastening screws (Fig.11) and remove the base as shown in (Fig.12).
10. Remove the motor fastening screws and loosen its pulley screws (Fig.13).
11. Take out the M6 motor and substitute it with the new one
12. Lift the pulley to approximately 0.5mm from its upper limit and tighten its screws(Fig.13)
13. Push the motor outward, as shown in (Fig.9), and holding it in this position so as to maintain the belt in tension, tighten the motor fastening screws.
14. Tighten the base support screws (Fig.11).
15. To remount, repeat the above steps in inverse order: from 8 to 1.

Warning: Do not tighten the protective cover's set screw as this could result in mechanical malfunction of the sampling arm's vertical movement (Fig.4).

Warning: After having substituted the motor, it is necessary to mechanically align the probe with respect to the wash well and center all the other positions by following the procedures provided in Section 6.1.1 "Alignment and Adjustments".

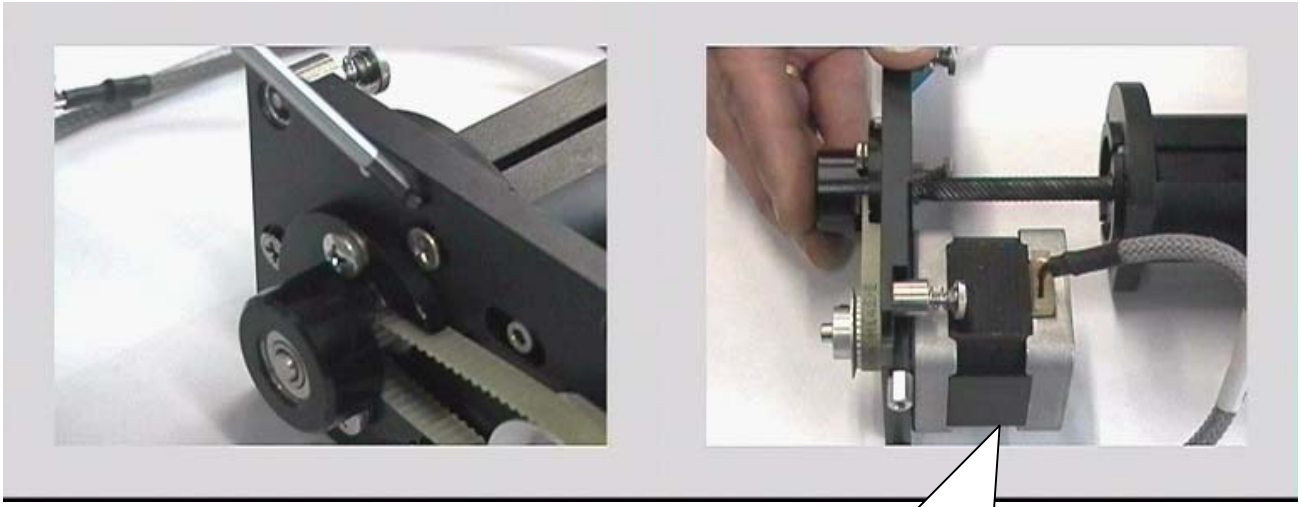


Fig. 11

Fig. 12

M5 Motor Assy (Vertical)
Cd. 10-00399-00

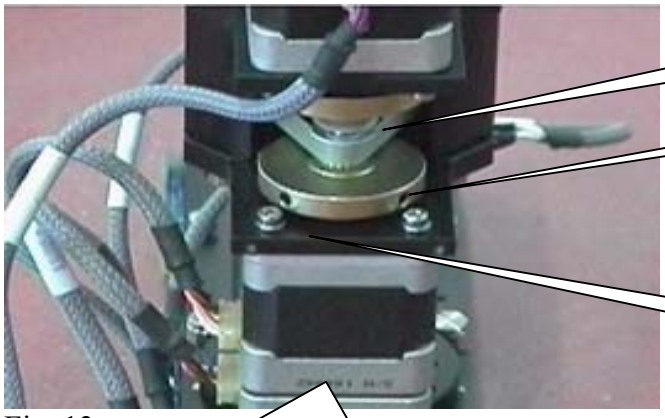


Fig. 13

6.1.4.3 Substitution of the M5 motor

N.B.: Make sure the instrument (Liasys) is turned off before performing this procedure.

Important: pay special attention to the Pre-heater when removing or servicing the sampling arm.

1. Remove the sampling probe.
2. Remove the samples and reagents racks' protective covers.
3. Remove the samples rack and reagents rack.
4. Unscrew the four cross bar fastening screws. Remove the cross bar by slipping out the Pre-heater guide support (Fig.1).
5. Remove the waste tube from the wash well.
6. Remove the teflon tube on the diluter head by unscrewing the fastening washer (Fig.2), paying special attention to leakage of liquid.
7. Unscrew the four anchored screws indicated in (Fig.3); unplug the J1, J2, J3, J15 and J17 connectors from the Sampling Interface assy; unplug the ground wire; remove the sampling arm.
8. Take the Sampling Interface assy out by unplugging the connectors and unscrewing the fastening screws (Fig.10).

N.B.: In order to be able to remove the M5 motor from its support, it is necessary to first partially disassemble the module as shown in Fig.12.

9. Unscrew the three fastening screws (Fig.11) and remove the base as shown in (Fig.12).
10. Remove the motor fastening screws and loosen its pulley screws (Fig.14).
11. Take out the M5 motor and substitute it with the new one
12. Lift the pulley to approximately 0.5mm from its upper limit and tighten its screws (Fig.14).
13. Push the motor outward, as shown in (Fig.9), and holding it in this position so as to maintain the belt in tension, tighten the motor fastening screws.
14. Tighten the base support screws (Fig.11).
15. To remount, repeat the above steps in inverse order: from 8 to 1.

Warning: Do not tighten the protective cover's set screw as this could result in mechanical malfunction of the sampling arm's vertical movement (Fig. 4).

Warning: After having substituted the motor, it is necessary to mechanically align the probe with respect to the wash well and center all the other positions by following the procedures provided in Section 6.1.1 "Alignment and Adjustments".

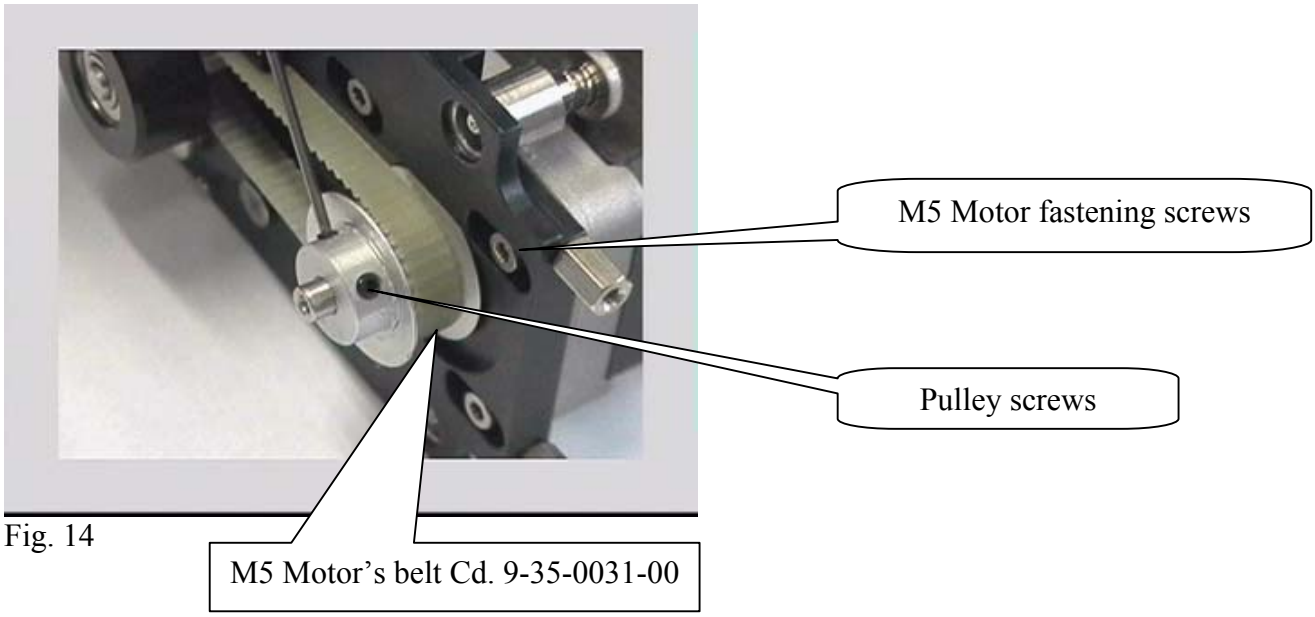


Fig. 14

6.1.5 PRE-HEATER AND LEVEL SENSOR

6.1.5.1 Substitution of the pre-heater and level sensor assembly

N.B.: Make sure the instrument (Liasys) is turned off before performing this procedure.

1. Remove the sampling probe.
2. Remove the samples and reagents racks' protective covers.
3. Remove the samples rack and reagents rack.
4. Unscrew the four cross bar fastening screws. Remove the cross bar by slipping out the rear Pre-heater guide support (Fig.2).
5. Remove the waste tube from the wash well.
6. Remove the teflon tube on the diluter head by unscrewing the fastening washer (Fig.3) pay particular attention to leakage of liquid.
7. Unplug connector J7 from the Sampling Interface assy.
8. Lift the teflon washer and expose the half-ring; remove the half-ring (Fig.4) and (Fig.5).
9. Remove the teflon washer and the spring (Fig.6).
10. Remove the Pre-heater assembly (Fig.7) and (Fig.8), making sure that the blocking pin remains in place.
11. Remount the new assembly, repeating the above steps in inverse order: from step 10 to step 1.

Note 1: the length of the Pre-heater supply cable from the top of the external arm to the intermediate guide must be approximately 23 cm (Fig.2).
Note 2: when remounting the teflon tube in the diluter, make sure that it is inserted correctly.

12. Turn on the Liasys system (instrument and computer).
13. Launch the diagnostic program. Select the "Diluter" function and press the "Probe Rinse Cycle" several times in order to fill the hydraulic circuit with liquid.

14. Make sure that no liquid leaks from the probe assembly and/or the dilutor. Make sure that the liquid flows from the probe freely.
15. Select the "Arm" key and then "Go Sample". Set Samples position #16. Make sure that the Pre-heater cable does not hinder the arm while it is in movement. If this situation should occur, turn the Pre-heater cable counter-clockwise in order to optimize the assembly.
16. Press the ”Reset” key
17. To exit the diagnostic program, press the "Diagnostic" key
18. To exit the analyzer program, press the "Shutdown" key.

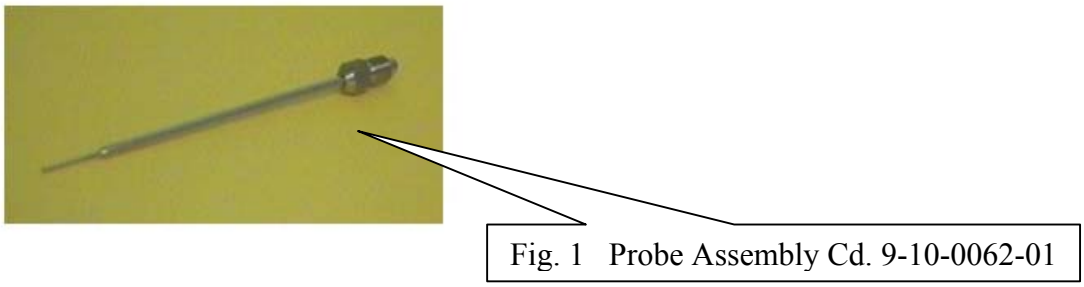


Fig. 1 Probe Assembly Cd. 9-10-0062-01

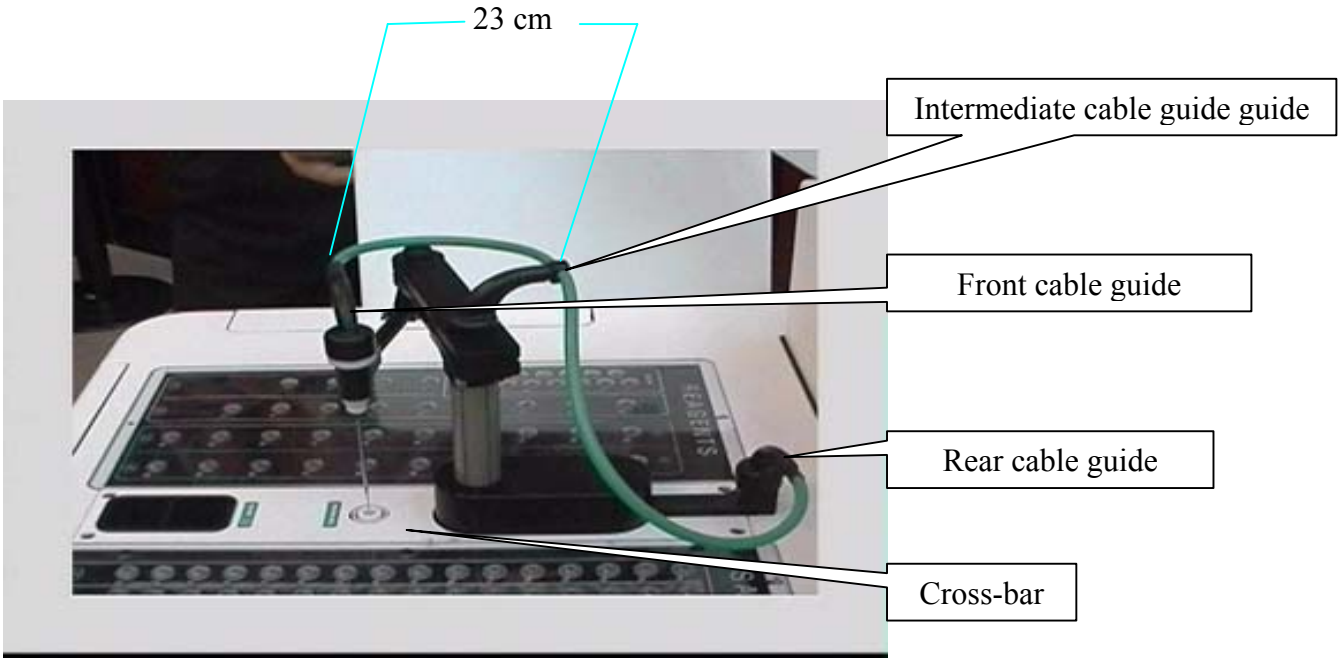


Fig. 2

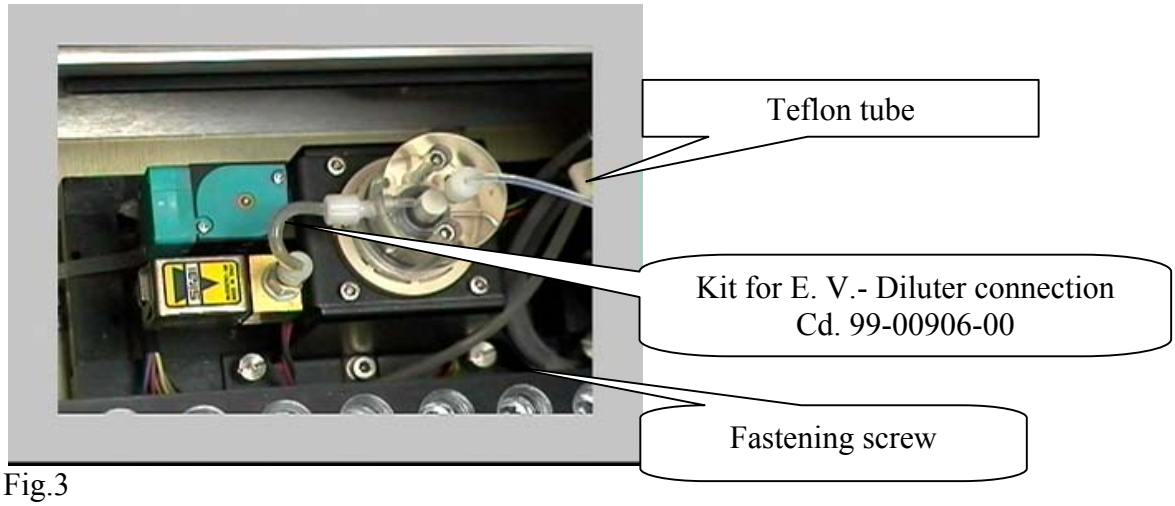


Fig.3

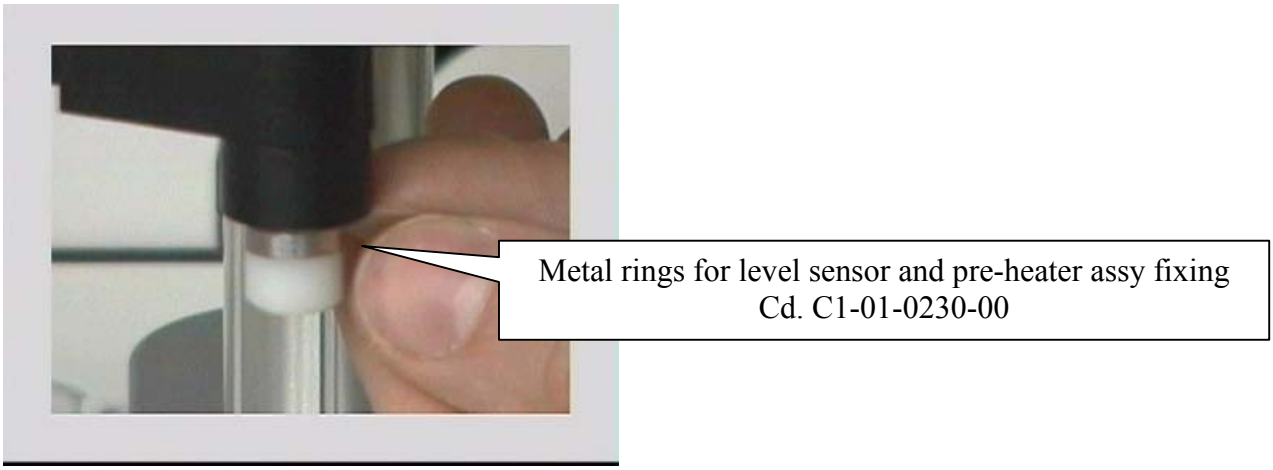


Fig. 4

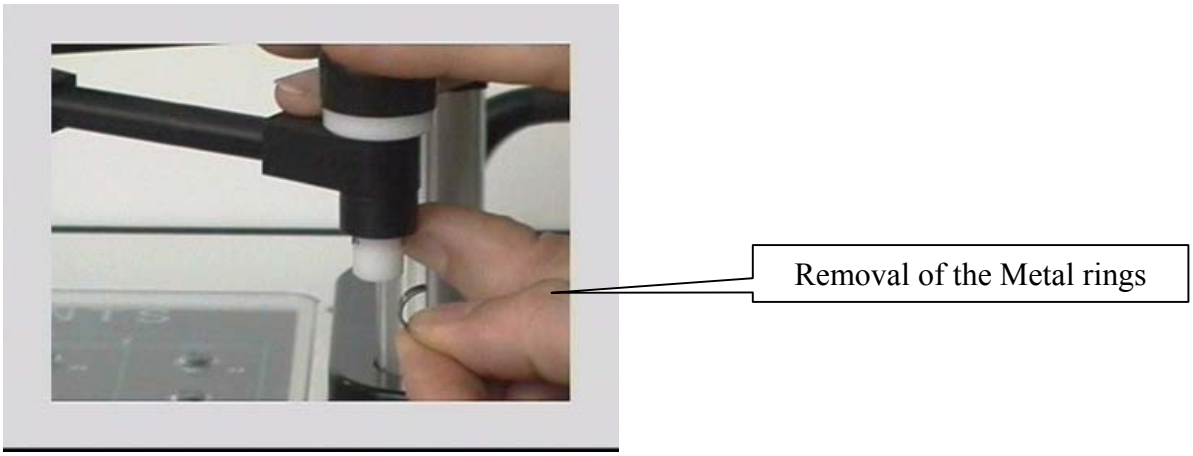


Fig. 5

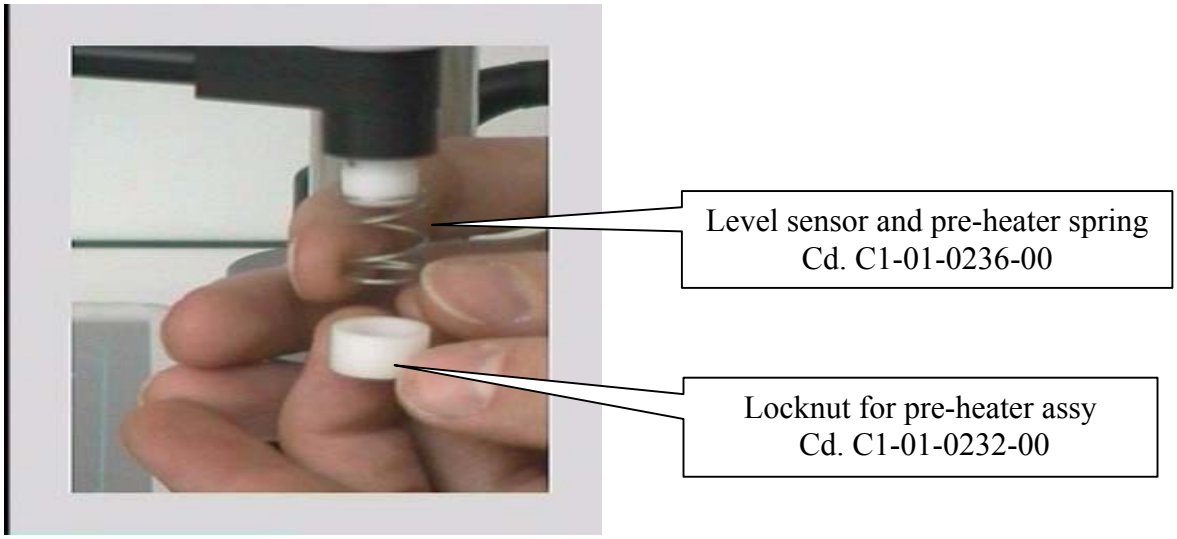

Level sensor and pre-heater spring
Cd. C1-01-0236-00
Locknut for pre-heater assy
Cd. C1-01-0232-00

Fig. 6

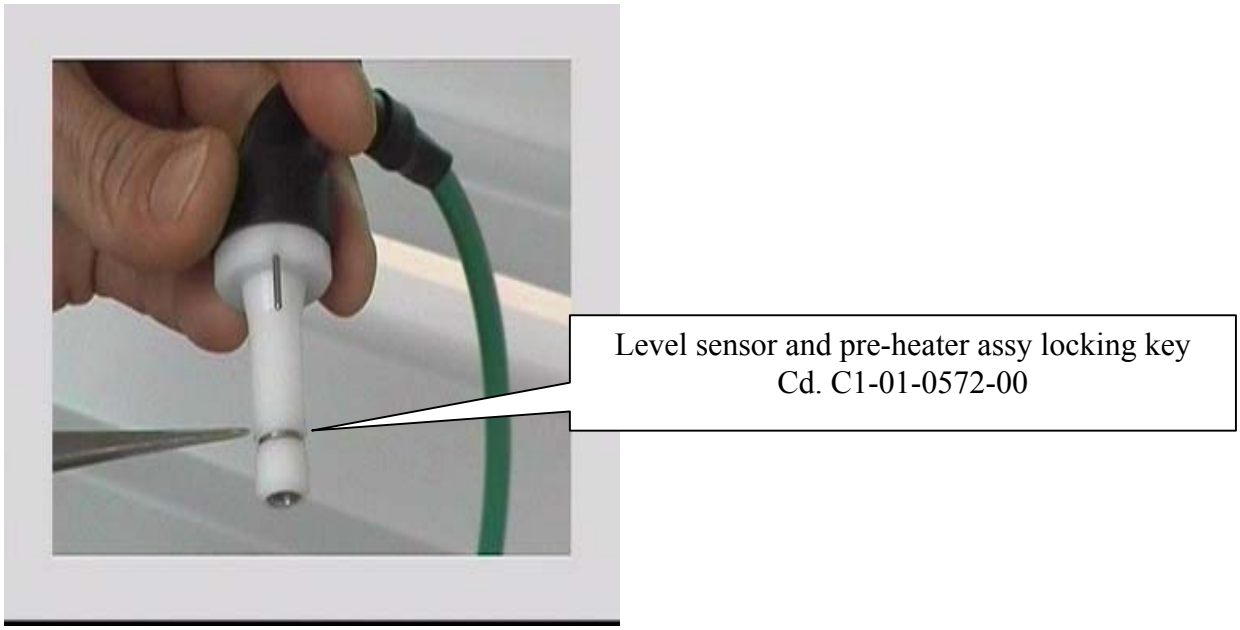

Level sensor and pre-heater assy locking key
Cd. C1-01-0572-00

Fig. 7

6.1.5.2 Level Sensor functioning Check

1. Turn on the Liasys system (instrument and computer).
2. Remove the protective cover of the samples rack.
3. Touch the sampling probe with your finger and make sure that the level sensor LED on the Sampling Interface assy turns on approximately one second, when the probe is touched (Fig. 9).

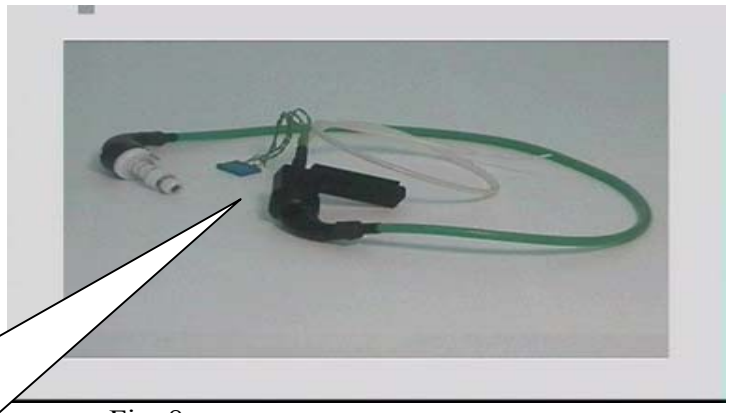


Fig. 8

Level Sensor and Pre-Heater assembly
Cd 9-10-0063-00

Sensor Level LED

Fig. 9 Sampling Interface assy
Cd. 30-00192-01

N.B.:during automatic functioning (routine analysis), every time the sampling probe dips into any liquid whatsoever, the "Level sensor" LED on the Sampling Interface assy will turn on for approximately one second. We advise that you never allow the level sensor to operate when the solution quantity is less than 290 µl.

4. In order to more specifically verify the correct level-sensing functioning, proceed as follows:

a) Place a cup containing liquid in the first samples rack, position nr 1 (Volume ≥ 290 µl).
b) Launch the diagnostic program. Select the "Arm" function and press the "Go Sample" key in order to allow the probe to move into the position corresponding to the sample cup.
c) In the window next to the "Go Level", enter the maximum descent of the probe (e.g.500).
d) Select "Go Level" and make sure that the probe drops down into the cup until it senses the liquid. In the window to the right of the "Go Level" key the level reached by the probe will appear, expressed in tenths of millimeters
e) Repeat step d) several times, each time returning to the Vertical "Home" position. Make sure that the level indicated remains constant ≤ 10 (1 mm).
f) Repeat steps b) to e) for positions 8 and 16 of the first rack using the same sample cup. Make sure that the difference between all the positions is ≤ 1mm.
g) Repeat steps b) to f) for samples racks three and five (Stat positions 1, 8, 14).
h) Press the "Back to Wash Well" key and then select "Go Sample" in order to allow the probe to return to a position in the rack, which does not contain any cup.
i) Select "Go Level" and make sure that the level reached is the maximum indicated in the given window is 9999.
j) Select the "Reset" key, remove the cups from the racks and exit the program by pressing the "Diagnostic" key.
k) To exit the analyzer program press “shutdown” key.

6.1.6 DILUTER MODULE

6.1.6.1 Substitution of the diluter module

N.B.: Make sure the instrument (Liasys) is turned off before performing this procedure.

1. Remove the samples and reagents protective covers (Fig.1).
2. Remove the samples rack and reagents rack.
3. Remove the teflon tube on the diluter head by unscrewing the fastening washer (Fig.2), paying special attention to leakage of liquid.
4. Unscrew the four anchored screws indicated in (Fig.2); unplug the J6, J8, and J13 connectors from the Sampling Interface assy (Fig.3). Remove the diluter and substitute it with the new one.
5. To remount, repeat the above steps in reverse order: from 4 to 1.
6. After mounting the new module, carry out the check procedure for mechanical functioning as described in Section 6.1.6.4

6.1.6.2 Substitution of the diluter micro-pump

N.B.: Make sure the instrument (Liasys) is turned off before performing this procedure.

1. Remove the samples and reagents protective covers (Fig.1).
2. Remove the samples rack and reagents rack.
3. Remove the teflon tube on the diluter head by unscrewing the fastening washer (Fig.2) paying particular attention to leakage of liquid.
4. Unscrew the four anchored screws indicated in (Fig.2); unplug the J6, J8, and J13 connectors from the Sampling Interface assy (Fig.3).
5. Remove the diluter module from the instrument.
6. Unscrew the two fastening screws on the micro-pump, take out the pump and substitute it with the new one (Fig.2)
7. To remount, repeat the above steps in reverse order: from 6 to 1.
8. After mounting the new micro-pump, carry out the check procedure for mechanical functioning as described in Section 6.1.6.4.

6.1.6.3 Substitution of the diluter Electro-valve

N.B.: Make sure the instrument (Liasys) is turned off before performing this procedure.

1. Remove the samples and reagents protective covers (Fig.1).
2. Remove the samples rack and reagents rack.
3. Remove the teflon tube on the diluter head by unscrewing the fastening washer (Fig.2) paying particular attention to leakage of liquid.
4. Unscrew the four anchored screws indicated in (Fig.2); unplug the J6, J8, and J13 connectors from the Sampling Interface assy (Fig.3).
5. Remove the diluter module from the instrument.
6. Unscrew the two fastening screws on the electro-valve, take it out and substitute it with the new one (Fig.2)
7. To remount, repeat the above steps in reverse order: from 6 to 1.
8. After mounting the new electro valve, carry out the check procedure for mechanical functioning as described in Section 6.1.6.4.

6.1.6.4 Diluter module - Check procedure for mechanical functioning

1. Turn on the Liasys system (instrument and computer).
2. Remove the protective cover of the samples and of the reagents (Fig.1).
3. Launch the Diagnostic program, select the "Diluter" function" and click on "Home" field. Make sure that the "Home Sensor" Dil. shows green.
4. Select aspiration and then dispense volumes between 3 to 500 microliters clicking on the appropriate windows.
5. Make sure that the diluter both aspirates and dispenses as requested and that there is no leakage of liquid from the hydraulic connections.
6. Exit the Diagnostic program by pressing the "Diagnostic" key.
7. Exit the analyzer program press “shutdown” key.

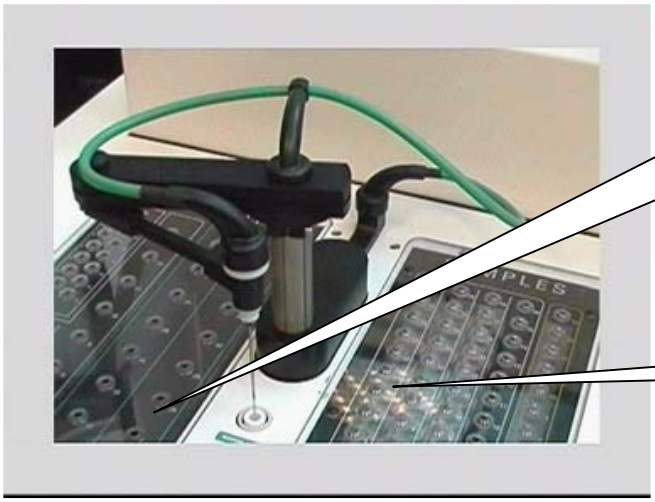


Fig.1

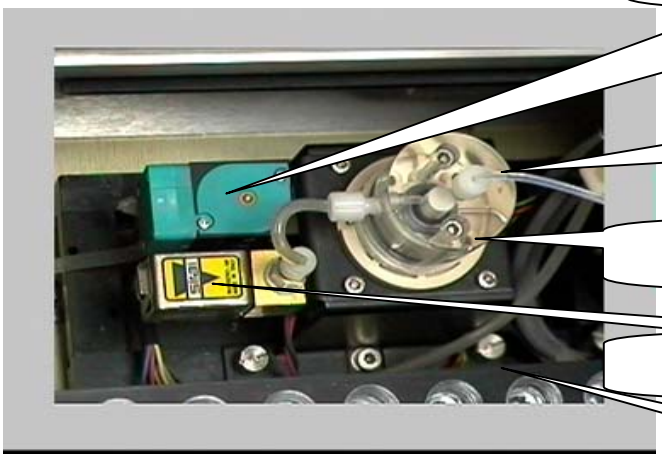


Fig. 2 Diluter Module

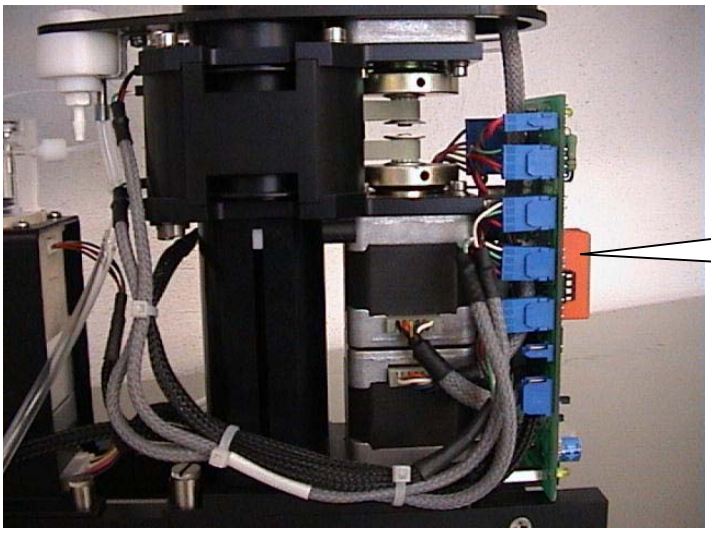


Fig. 3

6.2 OPTIC ASSEMBLY

6.2.1 SUBSTITUTION OPTIC ASSEMBLY

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure.**

1. Remove the cover panel of the reaction plate (Fig.1).
2. Unscrew the four cross-bar fastening screws and remove the cross-bar (Fig.1).
3. Unscrew the 4 fastening screws on the reaction plate assembly (Fig.2).
4. Remove the J1, J2 connectors and the ground wire from the Reaction Chamber Motor Interface board (Fig.2).
5. Remove the J1, J2, J14 connectors and the ground wire from the Reaction Plate Interface board (Fig.2).
6. Open the peristaltic pump assembly panel cover. Unscrew the two fastening screws to make free the support that join the seven tubes coming from the washing station probes.
7. Disconnect the six tubes coming from the washing station probes and the air tube inserted on the micro pump P4 coming from the porous pad on fifth probe of the washing station.
8. Remove the reaction plate from the instrument.
9. Remove the lamp's power supply wires connected to the Lamp Regulator board by loosening the two screws on the M1 connector (Fig. 4).
10. Remove the J1 connectors from the Preamp/ADC (Fig.5) and the ground wire from the optic group.
11. Unscrew the four fastening screws, remove the optic assembly and substitute it with the new one (Fig. 3).
12. Remount the assembly, repeating the above steps, 11 through 1, in reverse order.
13. After remounting, reseat the lamp and carry out the electronic adjustment check procedures as described in Sections 6.2.2 and 6.2.3

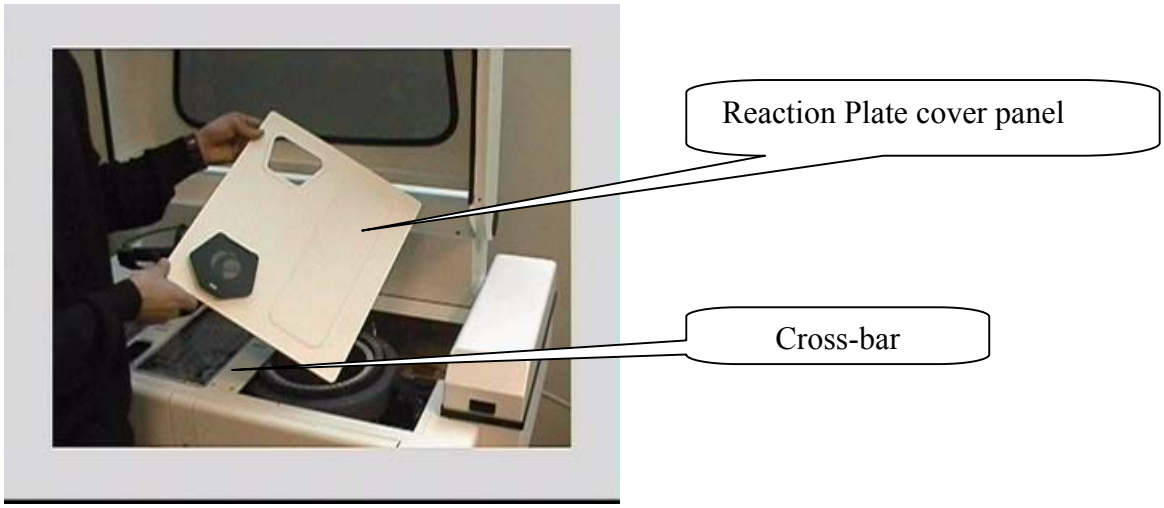


Fig. 1

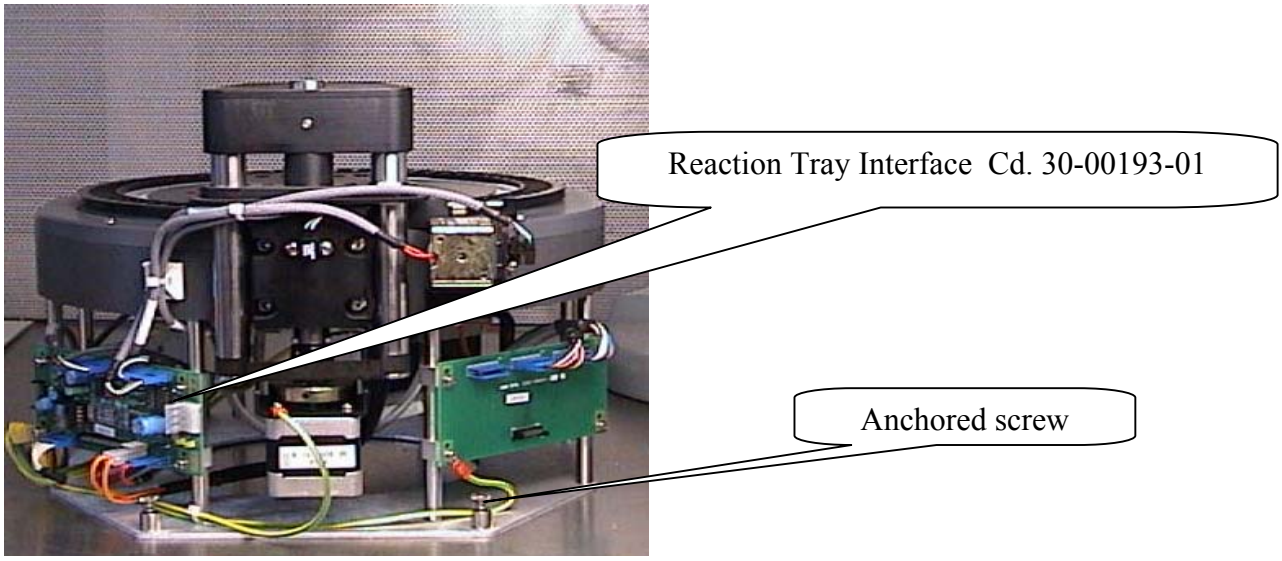


Fig. 2 Reaction Plate assembly Cd. 9-10-0061-01 *

*Reaction Plate assembly is supplied without Washing station and Photometer

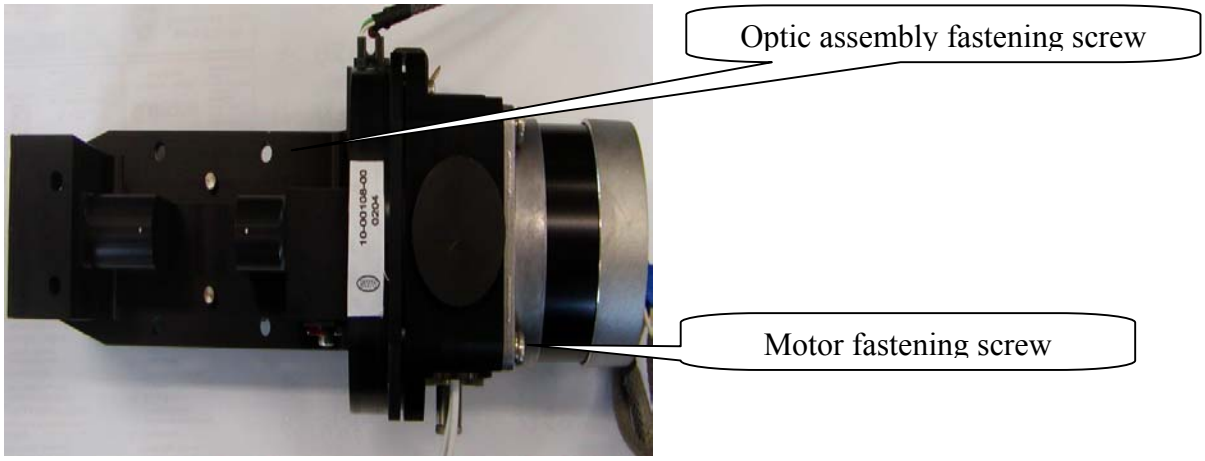


Fig. 3 New photometer assy (2optic Channel)
Cd. 10-00108-00

6.2.2 SUBSTITUTION OF THE PHOTOMETER LAMP

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure.**

1. Remove the cover panel of the reaction plate (Fig.1).
2. Remove the lamp's electrical wires connected to the Lamp Regulator board by loosening the two screws on the M1 connector (Fig.4).
3. Unscrew the lamp's fastening screws and remove it from its housing.
4. Remount the new lamp, repeating the above steps, 3 through 1, in reverse order.
5. Carry out the electronic adjustment of the photometer as described in Section 6D.2.1.

Warning: Do not touch the glass portions of the lamp.

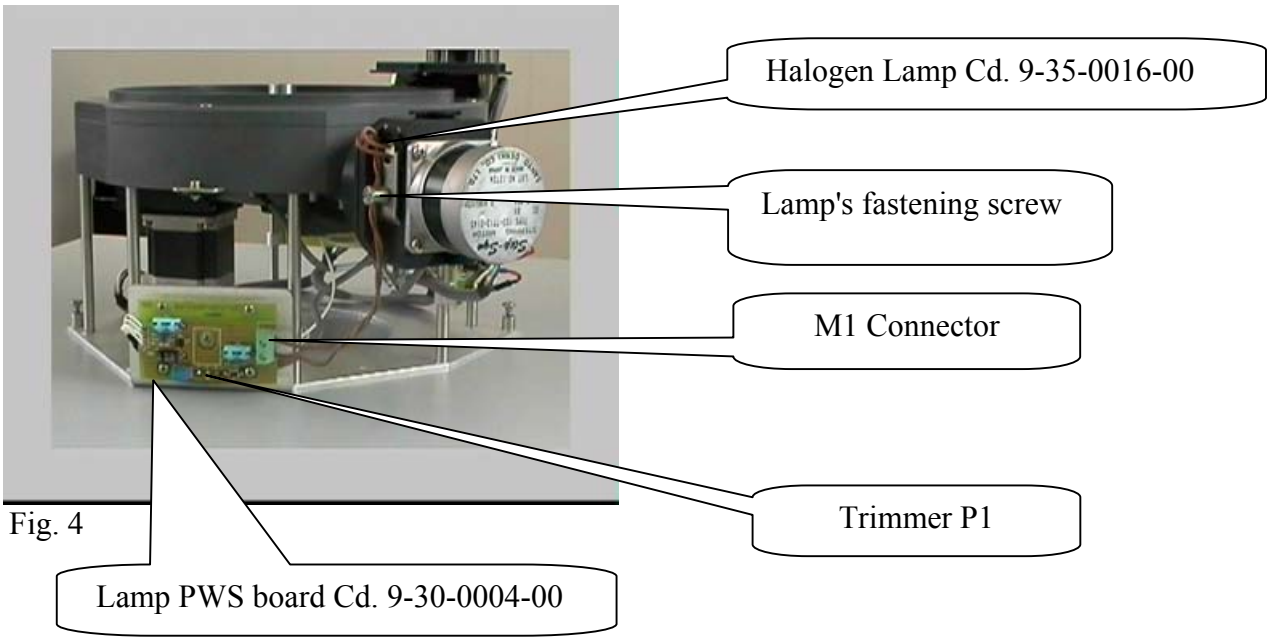


Fig. 4

6.2.3 ELECTRONIC ADJUSTMENT OF THE PHOTOMETER

Warning: make sure that the photometer lamp and the reaction cuvettes are brand-new before applying the following procedure.

1. Turn on the "Liasys" system /first the instrument and then the computer). Remove the reaction plate cover (Fig.1).
2. Launch the diagnostic program, select the "Plate" function and reset by clicking on the appropriate key.
3. Make sure that the "Home Sensor" Reaction Plate window lights up green.
4. Place 500 µL of distilled water in cuvette #31 of the reaction plate.
5. Select the "Optic" function and turn the lamp "On" by clicking on the appropriate field.
6. Reset the filter wheel by clicking on the appropriate key.
7. Make sure that "Home Sensor" Filter Wheel window lights up green.
8. Make sure that the Regulator board for Connector M1 shows 6.0 volts ± 0.1. If not, turn the P1 trimmer (Fig.4).

N.B.: The reaction cuvette must be perfectly clean. If not, carry out a "Cuvette Wash" cycle (Start Work)

Warning: Room lighting and daylight can influence the reading. To avoid this interference, replace the reaction plate cover panel before carrying out any check procedures.

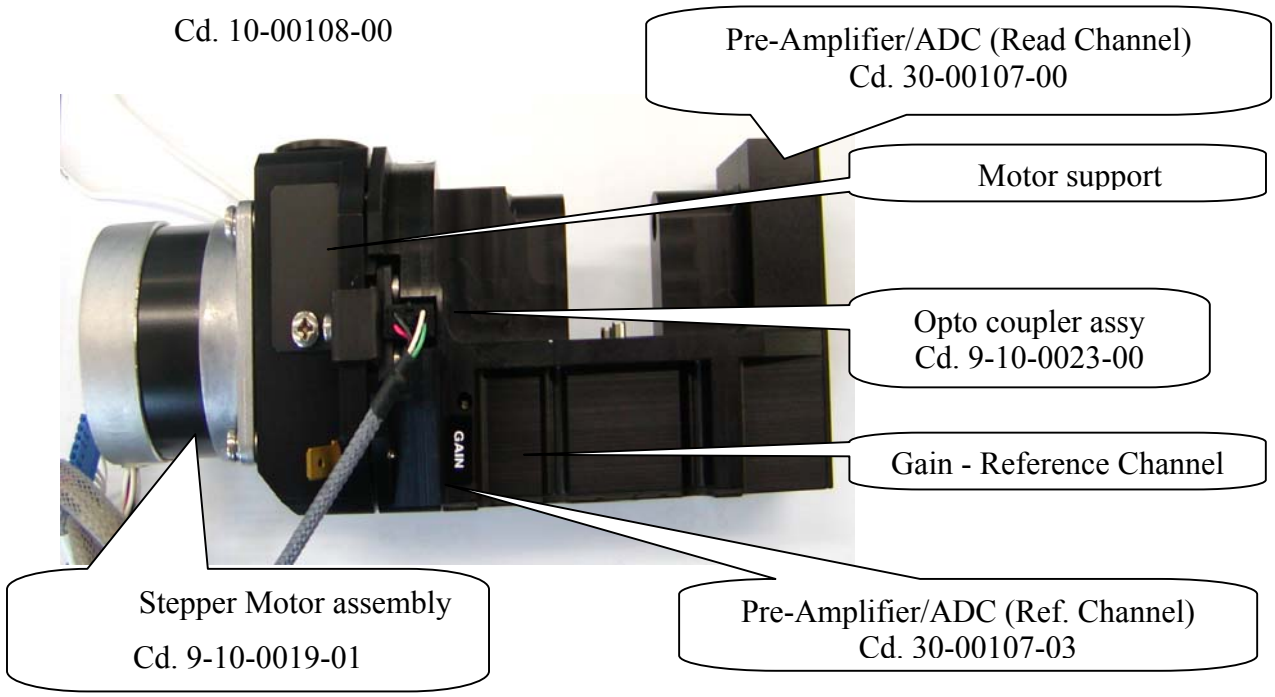
9. Click on "Start Sample Channel Conversion" key and make sure that the adjacent window shows a count value of 100 ± 50. If not, adjust the Preamp/ADC board "Offset" trimmer inside the analysis plate in order to set the desired value (Fig. 5).
10. After regulating of the main channel offset, it is necessary to click on " Stop Sample Channel Conversion" key.
11. Click on "Start Reference Channel Conversion" and make sure that the adjacent window shows a count value of 100 ± 50. If not, adjust the Preamp/ADC board "Offset" trimmer of the reference channel located external to the analysis plate in order to set the desired value (Fig. 5).
12. After regulating of the reference channel offset, it is necessary to click on " Stop Reference Channel Conversion" key.

13. Select the filter positions from 1 to 8 (from 340 nm to 620 nm) and click on" Start/Stop Sample Channel Conversion" key and determine **which filter transmit the highest signal.**
14. Verify in the adjacent window a count value of 55.000 ± 60.000. If not, adjust the Preamp/ADC board "Gain" trimmer inside the analysis plate in order to set the desired value (Fig. 5).
15. After regulating the Gain, select all the other filters and clicking on "Start/Stop Sample Channel Conversion" verify count values between 29.000 and 60.000

Warning: Room lighting and daylight can influence the reading. To avoid this interference, replace the reaction plate cover panel before carrying out any check procedures.

16. Select the highest signal filter, identified in point 13. Click on "Start Reference Channel Conversion" and make sure that the adjacent window shows a count value of 38.000 ± 42.000. If not, adjust the Preamp/ADC board "Gain" trimmer external to the analysis plate in order to set the desired value (Fig. 5).
17. After regulating the Gain, select all the other filters and clicking on "Start/Stop Reference Channel Conversion" verify count values between 29000 and 42000.
18. After concluding these operations, empty cuvette #31 and exit the diagnostic program by clicking on the "Diagnostic" key.
19. Exit the analyzer program press "shutdown" key.

Fig. 5 New photometer assy (2optic Channel)
Cd. 10-00108-00



6.2.4 SUBSTITUTION OF THE OPTO SENSOR

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure.**

1. Remove the cover panel of the reaction plate (Fig.1).
2. Unscrew the four cross-bar fastening screws and remove the cross-bar (Fig.1).
3. Unscrew the 4 fastening screws on the reaction plate assembly (Fig.2).
4. Remove the J1, J2 connectors and the ground wire from the Reaction Chamber Motor Interface board (Fig.2).
5. Remove the J1, J2, J14 connectors and the ground wire from the Reaction Plate Interface board (Fig.2).
6. Open the peristaltic pump assembly panel cover. Unscrew the two fastening screws to make free the support that join the six tubes coming from the washing station probes.
7. Disconnect the seven tubes coming from the washing station probes and the air tube inserted on the micro pump P4 coming from the porous pad on fifth probe of the washing station.
8. Remove the reaction plate from the instrument.
9. Remove the lamp's power supply wires connected to the Lamp Regulator board by loosening the two screws on the M1 connector (Fig. 4).
10. Unscrew the lamp's fastening screws and remove it from its housing.
11. Unscrew the four fastening screws on the motor support in order to access the filter wheel.
12. Position the filter wheel in such a manner as to make it possible to see and unscrew the internal opto sensor support screw. Unscrew the external opto sensor support screw.
13. Unscrew the optic sensor fastening screws from its support and substitute with the new one.
14. Remount the assembly, repeating the above steps, 12 through 1, in reverse order.
15. After remounting, reseat the lamp and carry out the electronic adjustment procedures as described in Sections 6.2.3

6.2.5 SUBSTITUTION OF THE MOTOR

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure.**

1. Remove the cover panel of the reaction plate (Fig.1).
2. Unscrew the four cross-bar fastening screws and remove the cross-bar (Fig.1).
3. Unscrew the 4 fastening screws on the reaction plate assembly (Fig.2).
4. Remove the J1, J2 connectors and the ground wire from the Reaction Chamber Motor Interface board (Fig.2).
5. Remove the J1, J14 connectors and the ground wire from the Reaction Plate Interface board (Fig.2).
6. Open the peristaltic pump assembly panel cover. Unscrew the two fastening screws to make free the support that join the six tubes coming from the washing station probes. Disconnect the seven tubes coming from the washing station probes and the air tube inserted on the micro pump P4 coming from the porous pad on fifth probe of the washing station.
7. Remove the reaction plate from the instrument.
8. Remove the lamp's power supply wires connected to the Lamp Regulator board by loosening the two screws on the M1 connector (Fig. 4).
9. Unscrew the lamp's fastening screws and remove it from its housing.
10. Unscrew the four fastening screws on the motor support in order to access the pulley.
11. Unscrew the four fastening screws on the motor; loosen the pulley fastening screws (Fig.3).
12. Remove the motor and substitute it with the new one.
13. Remount the assembly, repeating the above steps, 12 through 1, in reverse order.

Warning: when tightening the motor pulley fastening screws, make sure that the filter wheel is centered with respect to the opto sensor.

14. After remounting, reseat the lamp and carry out the electronic adjustment procedures as described in Sections 6.2.2 and 6.2.3

6.2.6 SUBSTITUTION OF THE OPTIC FILTERS

Interferential filters Kit Cd. 9-65-0029-00

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure.**

1. Remove the cover panel of the reaction plate (Fig.1).
2. Unscrew the four cross-bar fastening screws and remove the cross-bar (Fig.1).
3. Unscrew the 4 fastening screws on the reaction plate assembly (Fig.2).
4. Remove the J1 connector and the ground wire from the Reaction Chamber Motor Interface board (Fig.2).
5. Remove the J1, J14 connectors and the ground wire from the Reaction Plate Interface board (Fig.2).
6. Open the peristaltic pump assembly panel cover. Unscrew the two fastening screws to make free the support that join the six tubes coming from the washing station probes. Disconnect the seven tubes coming from the washing station probes and the air tube inserted on the micro pump P4 coming from the porous pad on fifth probe of the washing station.
7. Remove the reaction plate from the instrument.
8. Remove the lamp's power supply wires connected to the Lamp Regulator board by loosening the two screws on the M1 connector (Fig. 4).
9. Unscrew the lamp's fastening screws and remove it from its housing.
10. Unscrew the four fastening screws on the motor support in order to access the filter wheel.
11. Unscrew the fastening screw that holds the elastic band that holds the filters.
12. Remove the filter from its housing and substitute it with the new one.
13. Remount the assembly, repeating the above steps, 11 through 1, in reverse order.
14. After remounting, reseat the lamp and carry out the electronic adjustment procedures as described in Sections 6.2.3.

Warning: Do not touch the glass parts of the filter.

Warning: when substituting an interferential filter due to malfunctioning or functional anomalies, it is always advisable to substitute the entire set of filters mounted on the instrument.

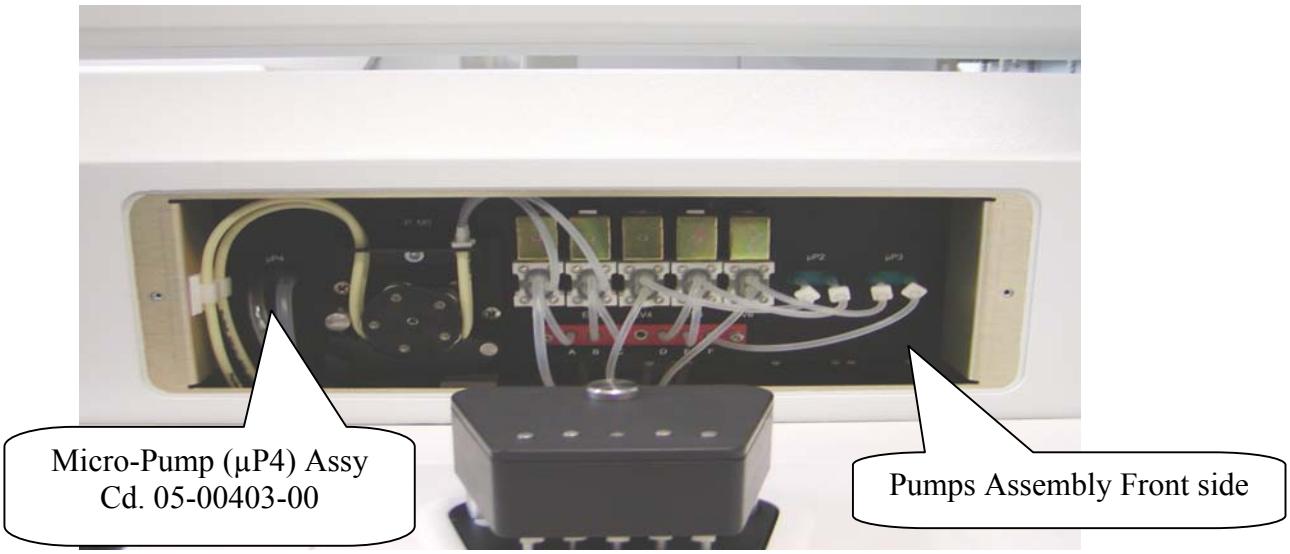
6.3 PUMP ASSEMBLY

6.3.1 SUBSTITUTION OF THE PUMP ASSEMBLY

N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure.

1. Unscrew the two knobs to remove the door located on the front elevation of the instrument (Fig. 1) and the two noticeable screws located on the rear panel (Fig. 2) to access the washing pump assembly.

Fig. 1



2. Disconnect connectors J1, J2 e J8 from the Hydraulics Interface board (rear side Fig.2)
3. Disconnect the air tubes from µP4 and the waste tubes coming from the peristaltic pump (front side, Fig. 1)
4. Disconnect the three tubes inserted on the EV1, EV4 ed EV6 valves, respectively coming from the washing well, from the distilled water bottle and from the cleaning solution bottle (front side, Fig. 1)
5. Unscrew the four screws which hold the Pumps Assembly. Remove it from its site (rear side Fig.2) and replace the Assembly with the new one.
6. Remount, repeating the above steps, 5 through 1, in reverse order.

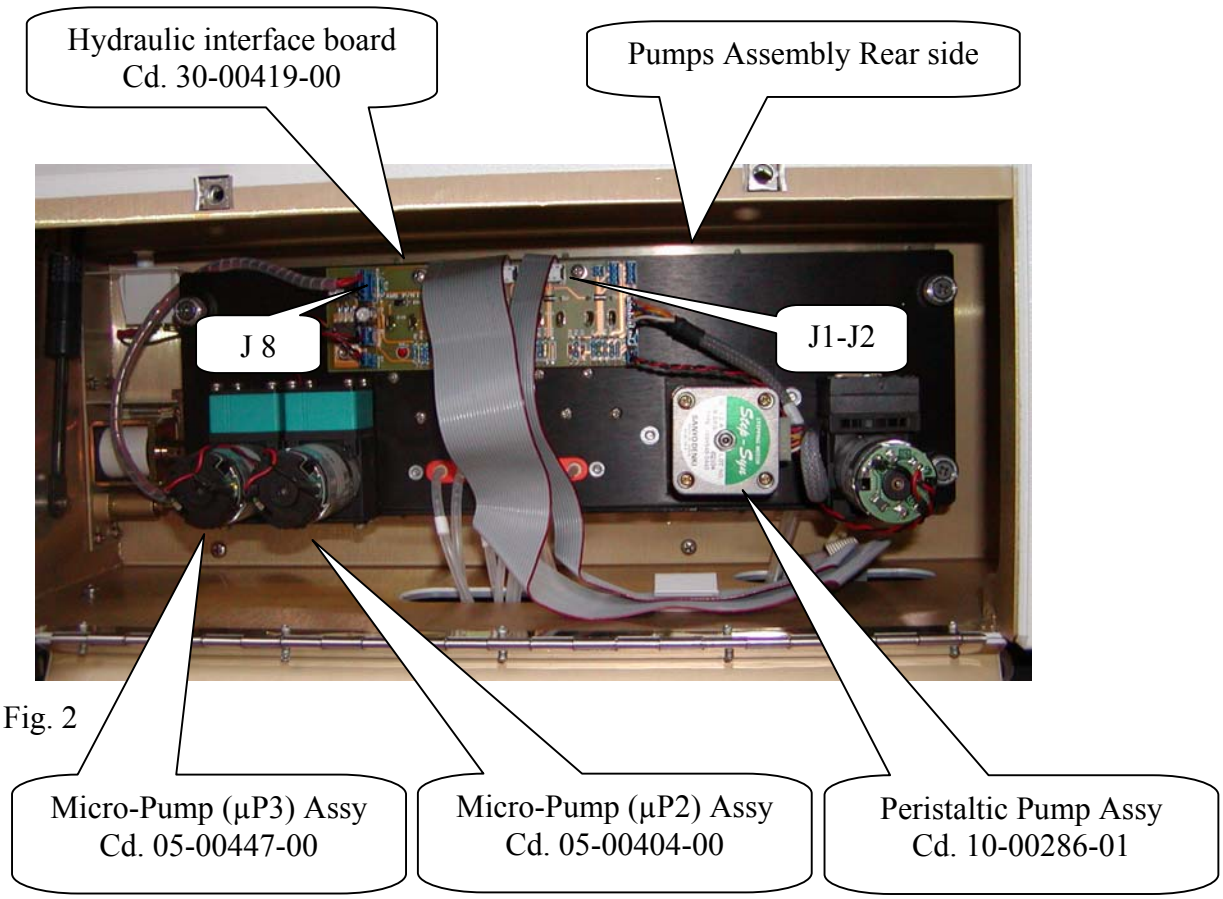
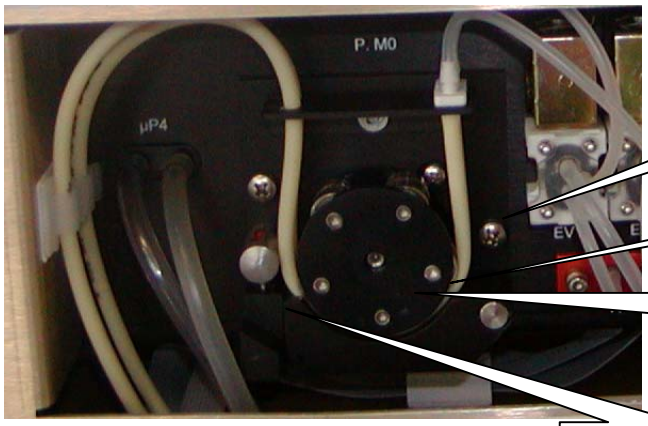


Fig. 2

6.3.2 SUBSTITUTION OF THE PERISTALTIC PUMP MOTOR

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure.**

1. Unscrew the two knobs to remove the door located on the front elevation of the instrument (Fig. 1) and the two noticeable screws located on the rear panel (Fig. 2) to access the washing pump assembly.
2. Unlock the hinged tube guide by lowering and rotating the guide lock to the left in order to free the tubes (Fig. 3).
3. Disconnect the connector J6 from the Hydraulics Interface Board (Rear side Fig.2)
4. Unscrew the two motor fastening screws and remove the peristaltic pump assembly from its site (Front side Fig.3)
5. Unscrew the four screws which hold the motor and loosen the two grains which hold the peristaltic wheel.
6. Remove the motor and substitute it with the new one.
7. Remount, repeating the above steps, 6 through 1, in reverse order.



Motor fastening screws

Hinged guide tube

Peristaltic Pump Rotor
Cd. 99-00902-00

Hinged guide lock

Fig. 3

6.3.2.1 Function check for the peristaltic pump

1. Turn on the Liasys system and launch the "Analyzer" program. Select "Start Work" and perform one or more cuvette washing cycles. Make sure that the sampling probe washing well empties completely without any leakage of liquid. If leakage should occur, adjust the screw indicated in Fig. 5 using the Peristaltic Pump Setting Gage as illustrated in figure 6 (See Service News N° 9 dated 21.05.2003)
2. Close the "Liasys" program by clicking on "Shutdown".

6.3.3 SUBSTITUTION OF PART(S)

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure.**

1. Unscrew the two knobs to remove the door located on the front elevation of the instrument (Fig. 1) and the two noticeable screws located on the rear panel (Fig. 2) to access the washing pump assembly.
2. For each part to be replaced, if necessary, disconnect the relative electrical power connection, the hydraulic tubes and the fastening screws.
3. If necessary, unscrew the four anchored screws of the assembly and turn it ahead (Fig.2).
4. Remount, repeating the above steps, 3 through 1, in reverse order.

Any necessary adjustments (in order to optimize pump aspiration in relation to the newly substituted tube) can be made by turning the relative screw (Fig. 5) using the Peristaltic Pump Setting Gage as illustrated in figure 6 (See Service News N° 9 dated 21.05.2003)

N.B:. If power loss is experienced in the filling or emptying of liquid (after a period of instrument activity), perform the following operations before substituting or servicing any part(s):

- Disconnect the liquid input tube from the malfunctioning pump.
- Insert a small amount of liquid using a syringe from the disconnected ends in order to wet the membranes (Fig. 4).
  Remove the syringe and reconnect the tube(s); perform functioning check as described in Section 6.3.2.1.

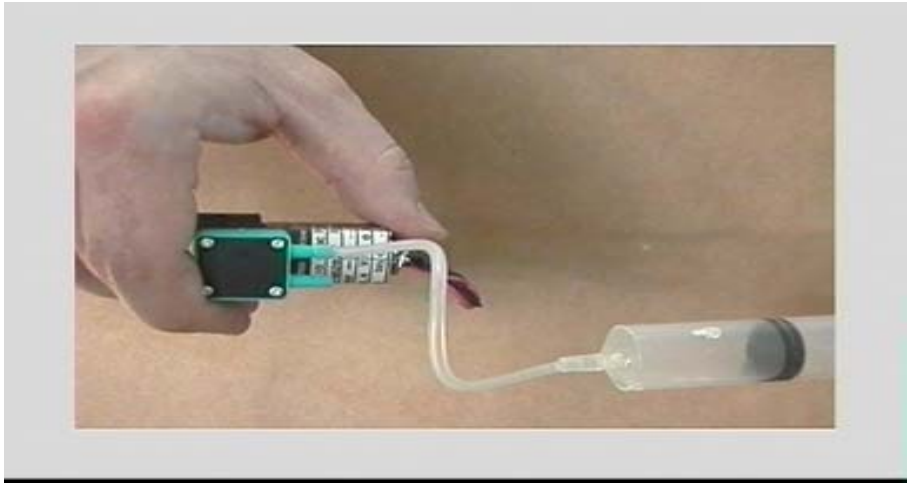


Fig. 4

6.3.4 MECHANICAL ADJUSTMENT OF THE PERISTALTIC PUMP

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this procedure.**

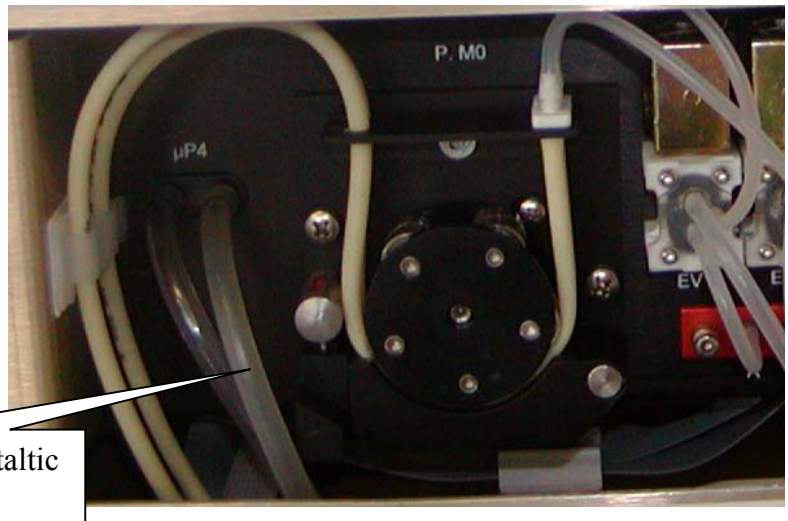
The peristaltic pump tubes must be substituted every three to six months, depending on instrument use.

6.3.4.1 How to substitute peristaltic pump tubes

1. Unscrew the two knobs on the cover, located on the instrument 'headboard' behind the washing station, in order to arrive at the pumps assembly (Fig. 1).
2. Unhook the hinged guide by lowering and rotating the guide's blocking bracket to the left thereby freeing the tubes (Fig.3).
3. Pull the tubes off their relative nipples and substitute with new ones.
4. Remount, repeating the above steps, 2 through 1, in reverse order.

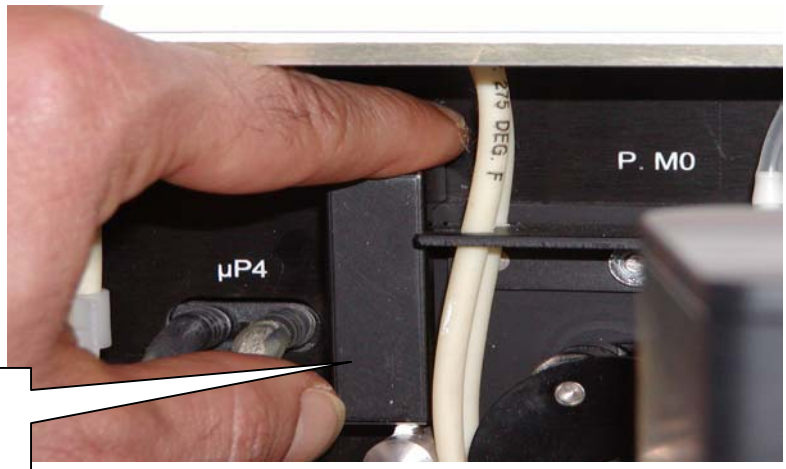
- Always use original replacement parts; never lubricate the peristaltic pump roller bearings.
- After prolonged instrument inactivity: verify the efficiency of the peristaltic pump tubes.

Please note: if the instrument is not able to completely empty the washing well, check the condition of the tube and make sure that the space between the hinged guide and the rotor is approximately 1.5 mm. Any necessary adjustments (in order to optimize pump aspiration in relation to the newly substituted tube) can be made by turning the relative screw (Fig. 5) using the Peristaltic Pump Setting Gage as illustrated in figure 6 (See Service News N° 9 dated 21.05.2003)



Screw for regulating peristaltic pump aspiration

Fig. 5



Peristaltic Pump Setting Gage
Cod. 01-01201-00

Fig. 6

6.4 REACTION PLATE

6.4.1 REACTION PLATE - MECHANICAL ADJUSTMENT

1. Turn on the Liasys system and launch the “Analyzer” program. Remove the reaction plate cover (Fig. 1).
2. Launch the diagnostic program, select the "Optic" function and turn on the light by clicking on the designated key.
3. Reset the filter wheel by clicking on the appropriate key.
4. Select key “Spare” to bring filter position # 9 to the 'reading' position.
5. Select the "Plate" function. Reset by clicking on the appropriate key. Make sure that the "Home Sensor" Reaction Plate window lights up green.
6. Make sure that the light beam inside the cuvette in centered with respect to the sides of the cuvette. If not, adjust the OS3 optic sensor regulating bar (Fig. 2).
7. To exit the diagnostic program press the "Diagnostic" key
8. To exit the analyzer program press “shutdown” key

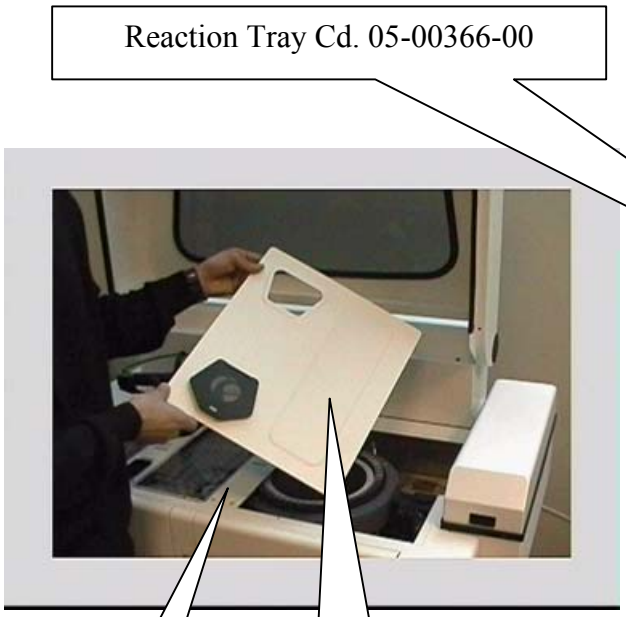


Fig. 1

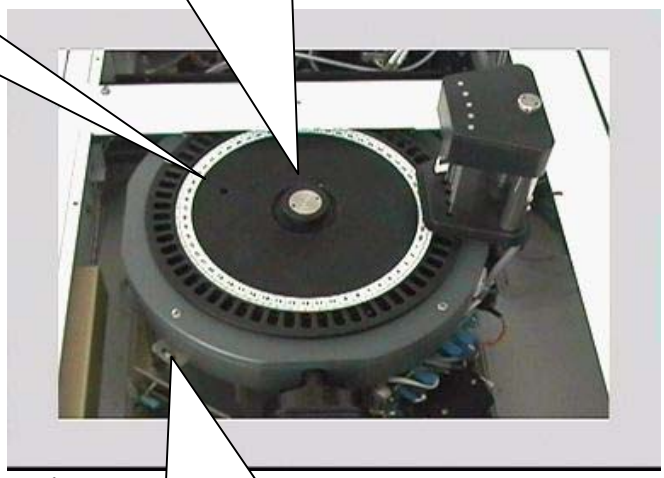


Fig.2

6.4.2 SUBSTITUTION OF THE REACTION PLATE

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure**

1. Remove the reaction plate cover (Fig. 1).
2. Unscrew the four cross-bas fastening screws and remove the cross-bar (Fig. 1).
3. Unscrew the four anchored screws of the reaction plate module (Fig. 3).
4. Remove the J1 connector and the ground wire from the Reaction Chamber Motor Interface.
5. Remove the J1, J14 connectors and the ground wire from the Reaction Plate Interface.
6. Remove the top cover of the washing station using the special wrench supplied by the manufacturer.
7. Disconnect the seven tubes attached to the probes on the washing station.
8. Remove the reaction plate from the instrument and substitute it with the new one.
9. Remount, repeating the above steps, 7 through 1, in reverse order.

N.B.: After substituting the reaction plate, carry out the mechanical adjustment procedure of the reaction plate as described in Section 6.4.1

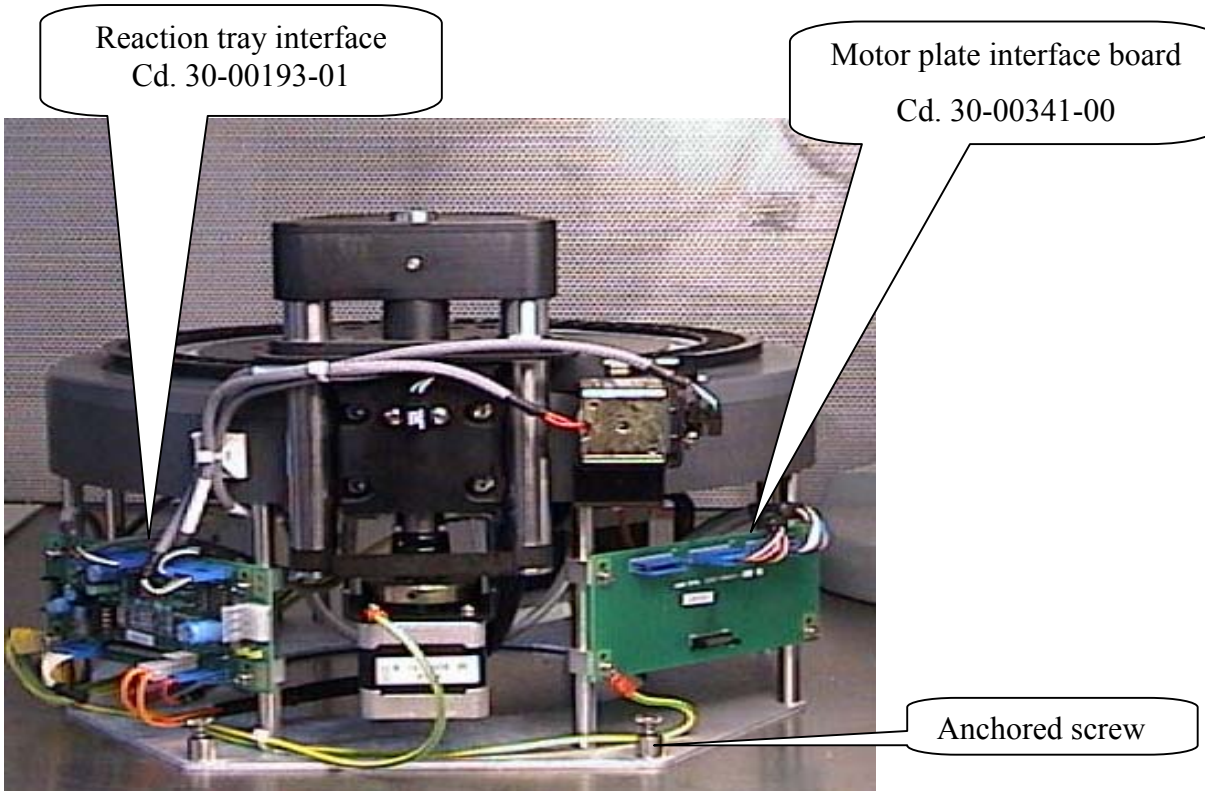


Fig. 3 Reaction Plate assembly Cd. 9-10-0061-01 *

* Reaction Plate assembly is supplied without Washing Station and Photometer

6.4.3 SUBSTITUTION OF THE OS3 OPTIC SENSOR

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure.**

1. Remove the reaction plate cover (Fig. 1).
2. Unscrew the four cross-bas fastening screws and remove the cross-bar (Fig. 1).
3. Unscrew the four anchored screws of the reaction plate module (Fig. 3).
4. Remove the J1 connector and the ground wire from the Reaction Chamber Motor Interface(Fig. 3).
5. Remove the J1, J4 and J14 connectors and the ground wire from the Reaction Plate Interface (Fig.3).
6. Open the cover panel of the peristaltic pump assembly and disconnect the seven tubes attached to the probes on the washing station.
7. Remove the reaction plate from the instrument.

8. Remove the fastening screw from the analysis plate using the special tool supplied by the manufacturer (Fig. 2).
9. Unscrew the two fastening screws from the bottom cover panel of the washing station and lift it. (Fig. 4).
10. Unscrew the two fastening screws on the cuvette holder assembly and lift it. This will make it possible to remove the analysis plate (Fig. 5).
11. Unscrew the two fastening screws on the optic sensor and substitute it with the new one.
12. Remount, repeating the above steps, 11 through 1, in reverse order.

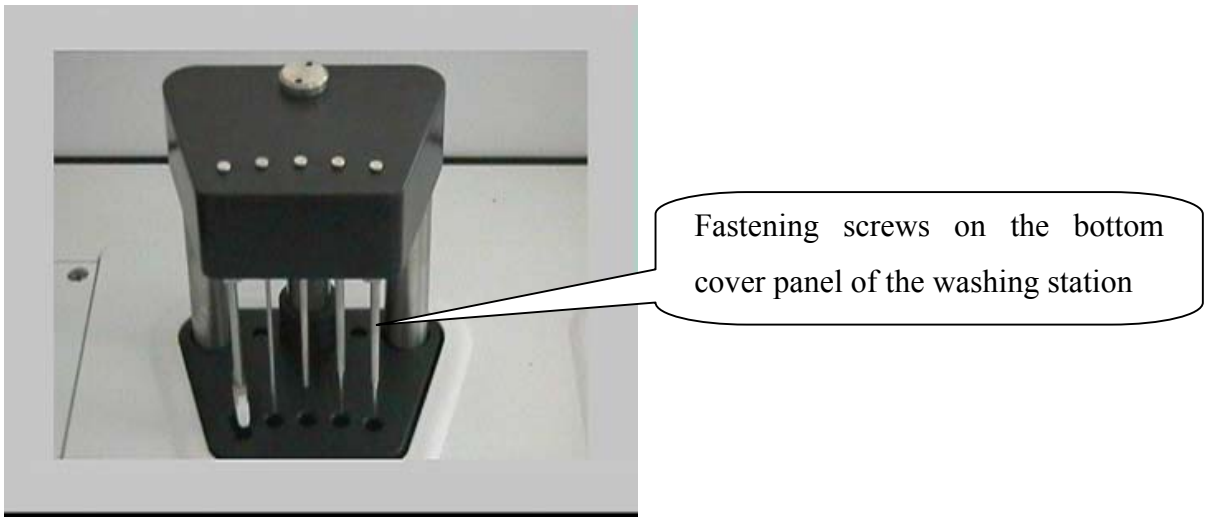


Fig. 4 Washing Station probes assembly Cd. 9-10-0006-00

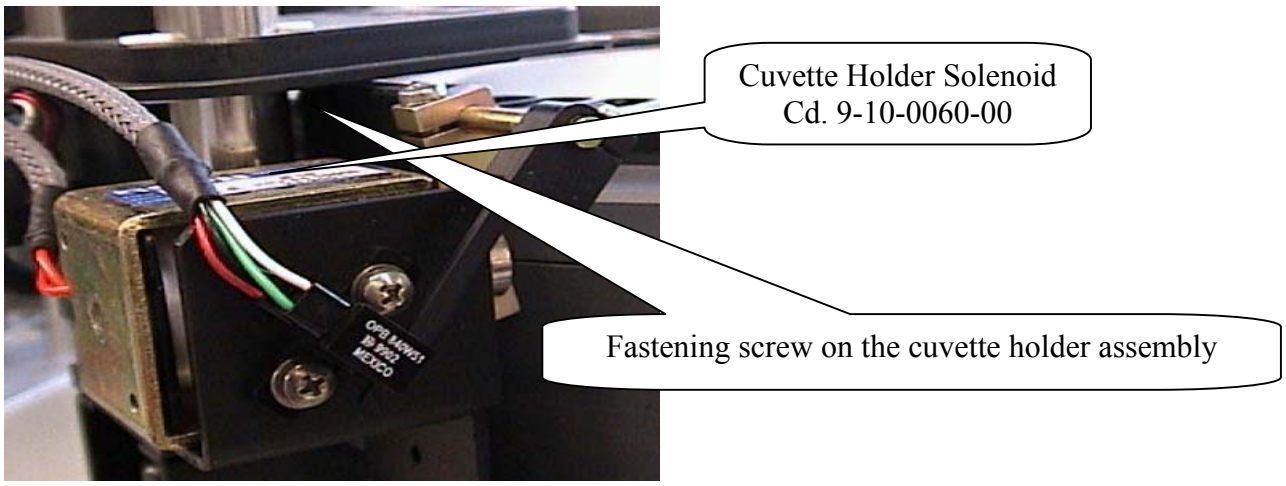


Fig. 5 Cuvette Holder

N.B.: After substituting the optic sensor, carry out the mechanical adjustment procedure of the reaction plate as described in Section 6.4.1

6.4.4 SUBSTITUTION OF THE M3 MOTOR

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure.**

1. Remove the reaction plate cover (Fig. 1).
2. Unscrew the four cross-bas fastening screws and remove the cross-bar (Fig. 1).
3. Unscrew the four anchored screws of the reaction plate module (Fig. 3).
4. Remove the J1 and J4 connectors and the ground wire from the Reaction Chamber Motor Interface (Fig. 3).
5. Remove the J1, J14 connectors and the ground wire from the Reaction Plate Interface (Fig. 3).
6. Open the cover panel of the peristaltic pump assembly and disconnect the seven tubes attached to the probes on the washing station.
7. Remove the reaction plate from the instrument.
8. Unscrew the four fastening screws that hold the motor support (Fig. 7).
9. Remove the four fastening screws on the motor (Fig. 8).
10. Remove the motor and substitute it with the new one.
11. Remount, repeating the above steps, 9 through 1, in reverse order.

Warning: Belt tension must be regulated by turning the M4 screw (shown in Fig. 7) clockwise by 1.3 Kg/cm.

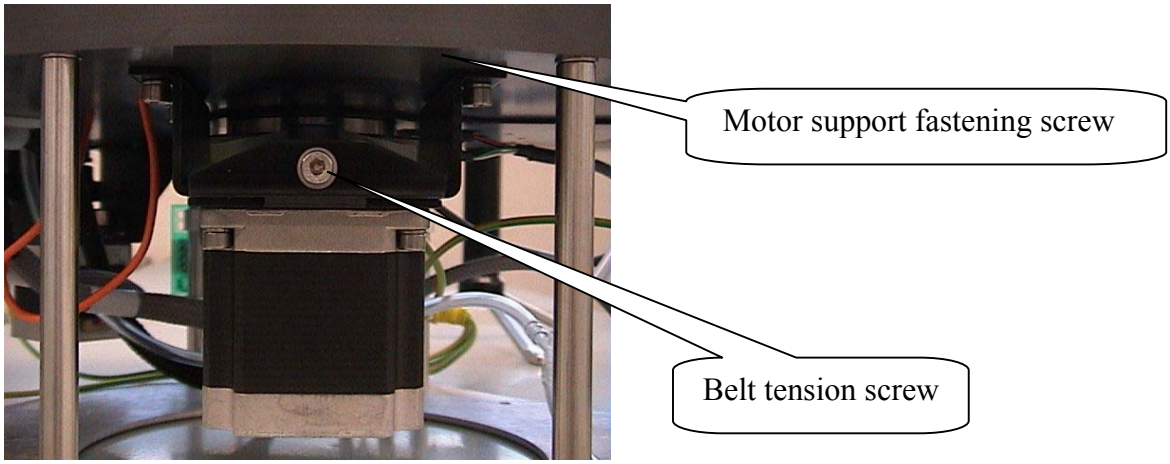


Fig. 7

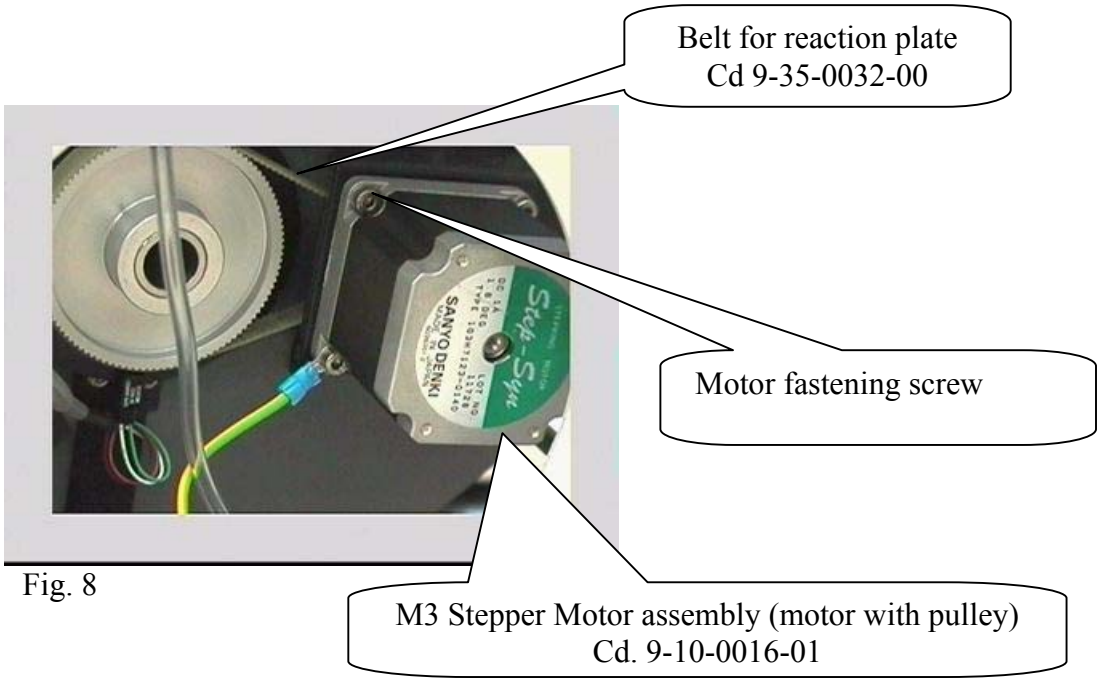


Fig. 8

N.B.: After substituting the motor, carry out the mechanical adjustment procedure of the reaction plate as described in Section 6.4.1

6.5 WASHING STATION ASSEMBLY

6.5.1 SUBSTITUTION OF THE WASHING STATION ASSEMBLY

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure.**

1. Remove the reaction plate cover (Fig. 1).
2. Unscrew the four cross-bas fastening screws and remove the cross-bar (Fig. 1).
3. Unscrew the four anchored screws of the reaction plate module (Fig. 2).
4. Remove the J1and J3 connectors and the ground wire from the Reaction Chamber Motor Interface (Fig. 2).
5. Remove the J1, J3, J5, J6, J14 connectors and the ground wire from the Reaction Plate Interface (Fig. 2).
6. Remove the top cover of the washing station using the special tool supplied by the manufacturer (Fig. 5).
7. Disconnect the seven tubes attached to the probes on the washing station (Fig. 6).
8. Remove the reaction plate from the instrument.
9. Unscrew the four fastening screws on the washing station assembly (Fig. 3).
10. Remove the washing station assembly and replace it with the new one.
11. Remount, repeating the above steps, 10 through 1, in reverse order.
12. After substituting and remounting, carry out the mechanical adjustment and functional check procedures as described in section 6.5.4

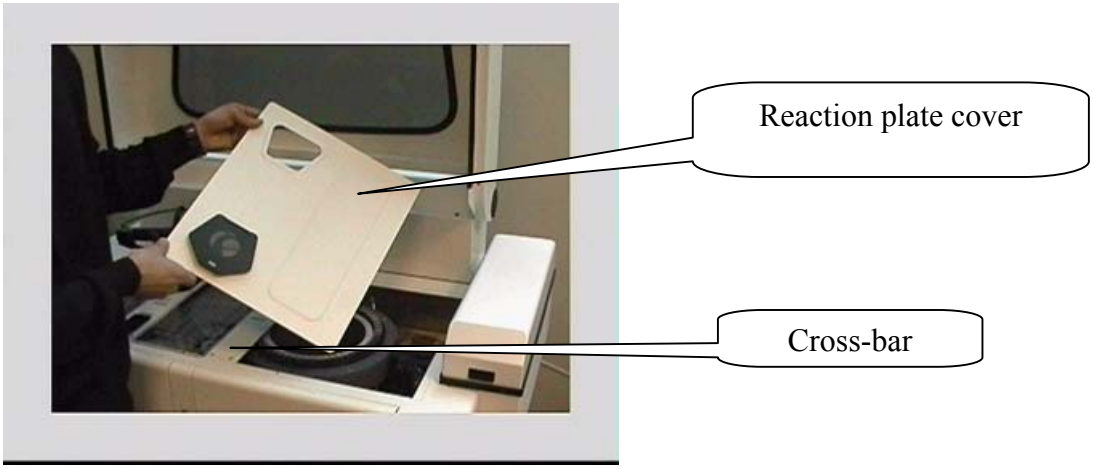


Fig. 1

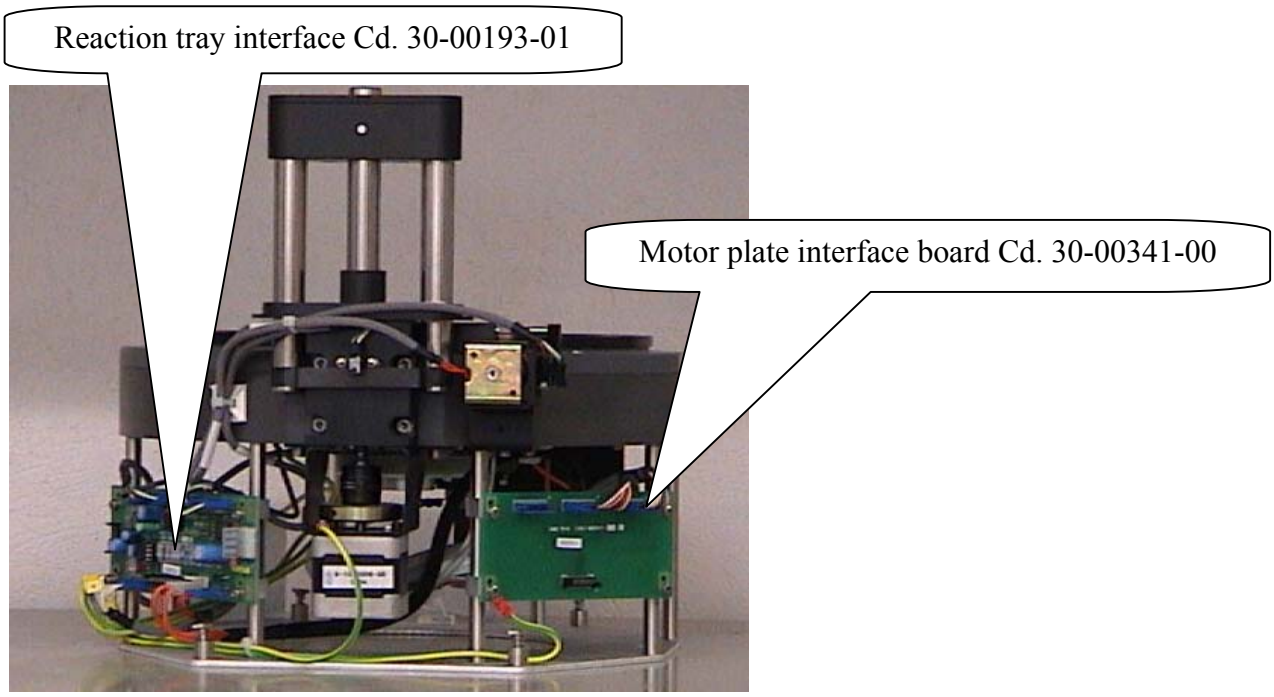


Fig. 2 Reaction Plate assembly Cd. 9-10-0061-01 *

* Reaction Plate assembly is supplied without Washing Station and Photometer

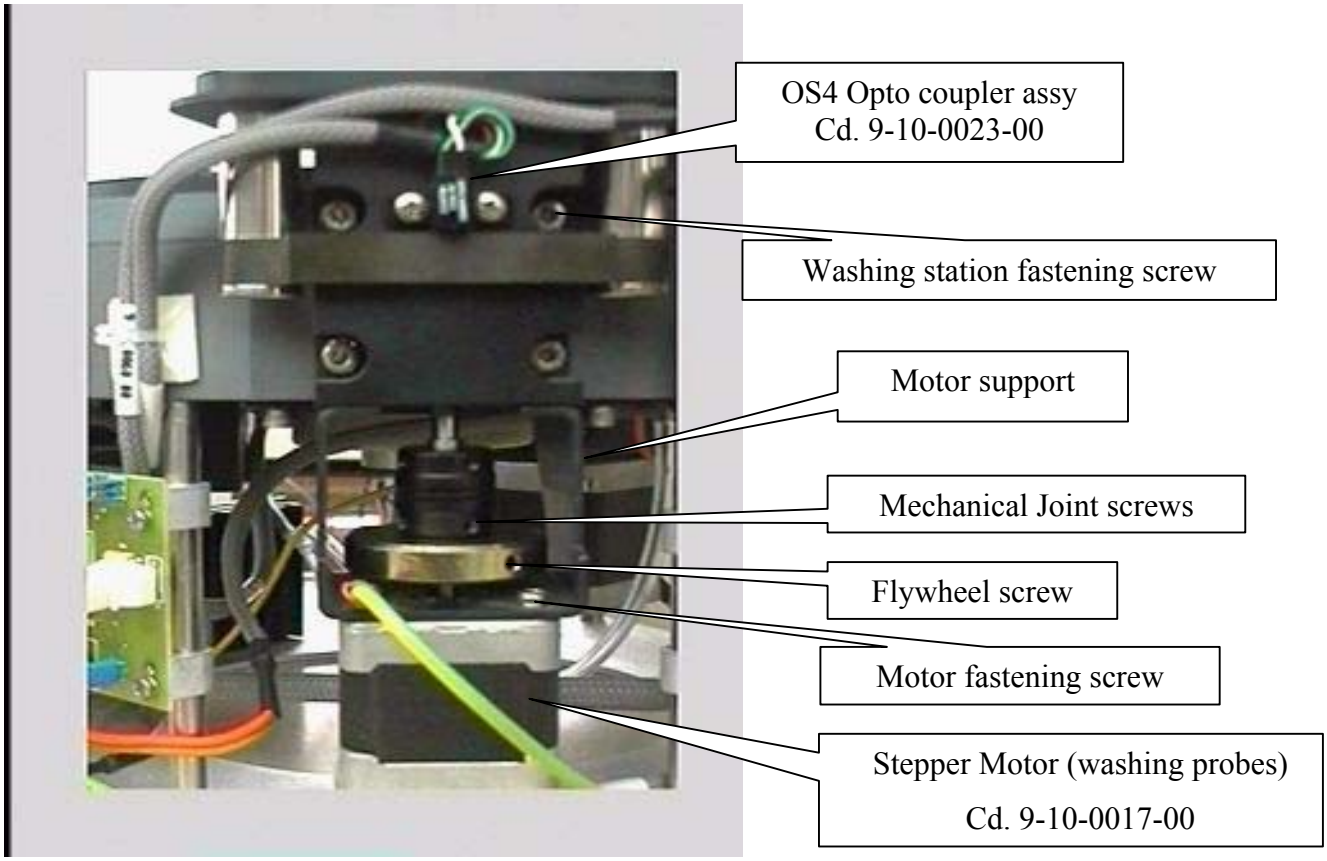


Fig. 3 Washing Station probes assembly Cd. 9-10-0006-00

6.5.2 SUBSTITUTION OF THE WASHING STATION OPTIC SENSOR

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure.**

1. Remove the reaction plate cover (Fig. 1).
2. Unscrew the four cross-bas fastening screws and remove the cross-bar (Fig. 1).
3. Unscrew the four anchored screws of the reaction plate module (Fig. 2).
4. Place the reaction plate vertically inside the instrument.
5. Remove the J3 connector from the Reaction Plate Interface (Fig.2).
6. Unscrew the two fastening screws on the optic sensor and substitute it with the new one (Fig. 3).
7. Remount, repeating the above steps, 6 through 1, in reverse order.
8. After substituting and remounting, carry out the mechanical adjustment and functional check procedures as described in section 6.5.4

6.5.3 SUBSTITUTION OF THE WASHING STATION MOTOR

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure..**

1. Remove the reaction plate cover (Fig. 1).
2. Unscrew the four cross-bas fastening screws and remove the cross-bar (Fig. 1).
3. Unscrew the four anchored screws of the reaction plate module (Fig. 2).
4. Place the reaction plate vertically inside the instrument.
5. Remove the J3 connector from the Reaction Plate Interface (Fig.2).
6. Loosen the two flywheel and motor joint screws (Fig. 3).
7. Unscrew the four fastening screws on the motor support and remove it (Fig. 3).
8. Unscrew the four fastening screws on the motor, substitute it with the new one (Fig. 3).
9. Remount, repeating the above steps, 8 through 1, in reverse order.
10. After substituting and remounting, carry out the mechanical adjustment and functional check procedures as described in section 6.5.4

6.5.4 WASHING STATION - MECHANICAL ADJUSTMENT AND FUNCTIONAL CHECK

6.5.4.1 Washing Station - Horizontal Alignment

1. Turn on the "Liasys" system and launch the “Analyzer” program
2. Launch the diagnostic program and select the "Plate" function.
   Reset by clicking on the appropriate key. Make sure the "Home Sensor" Reaction Plate window lights up green.
3. Select the "Washing" function. Reset by clicking on the appropriate key. Make sure the "Home Sensor" Washing Station window shows a green light.
4. Select several times "Home" and "Down" by clicking on the appropriate keys. Make sure the washing station probes enter the reaction cuvettes freely and totally unhindered. Pay particular attention to the drying pad placed on probe number five. If the drying pad does experience any friction whatsoever, loosen the two fastening screws on the bottom cover panel of the washing station and mechanically align the pad better (Fig. 5).
5. Upon completion of this procedure, tighten the fastening screws on the bottom cover of the washing station and exit the diagnostic program by clicking on "Diagnostic".
6. Carry out the functional check of the washing station as described in section 6.5.4.3

Fig. 5

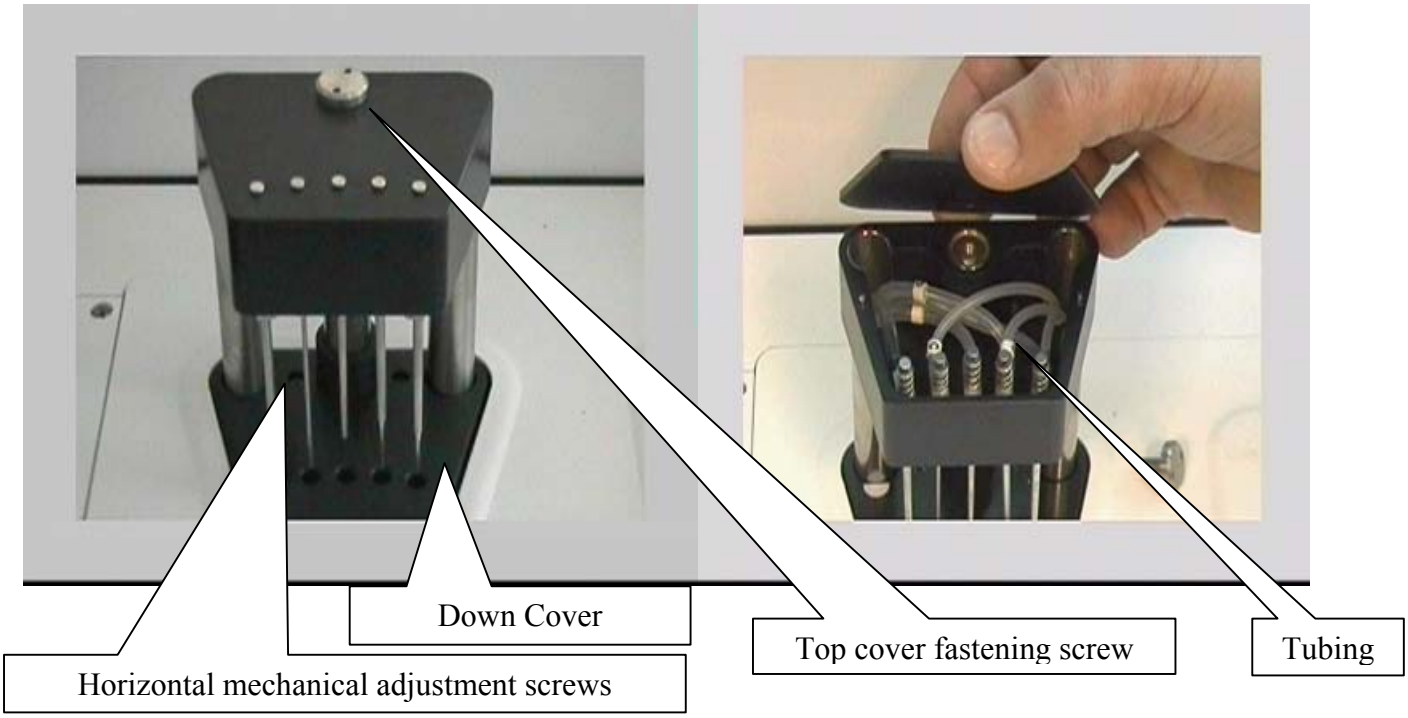


Fig. 6

6.5.4.2 WASHING STATION - VERTICAL ALIGNMENT

1. Turn on the "Liasys" system (first the instrument and then the computer).
2. Launch the diagnostic program and select the "Plate" function.
3. Reset by clicking on the appropriate key. Make sure the "Home Sensor" Reaction Plate window lights up green.
4. Select the "Wash" function. Reset by clicking on the appropriate key.
5. Make sure the "Home Sensor" Washing Station window shows a green light.
6. Select several times "Home" and "Down" by clicking on the appropriate keys. Make sure the washing station probes enter the reaction cuvettes freely and totally unhindered. Pay particular attention to the drying pad placed on probe number five.
7. The upper limit must be reached before the mechanical end of run. The lower limit must allow the drying pad to touch the bottom of the cuvette.
8. The washing station does not normally need vertical mechanical adjustment. If, however, it does, loosen the OS4 optic sensor fastening screws (Fig.3) and move it either up or down in order to correctly position the washing station. Upon completion of this procedure, tighten the optic sensor fastening screws and exit the diagnostic program by clicking on "Diagnostic".
9. Carry out the functional check of the washing station as described in section 6.5.4.3.

6.5.4.3 WASHING STATION - FUNCTIONAL CHECK

1. Turn on the "Liasys" system (first the instrument and then the computer).
2. Launch the "Liasys" program and, under System Monitor, carry out a wash cycle and reading cycle of the cuvettes using water (WBL).
3. Check system efficiency by comparing the obtained WBL values against the range of acceptance of WBL. Make sure there is no leakage of liquid inside the analyzer.

6.5.5 WASHING STATION - CUVETTE HOLDER ASSEMBLY

6.5.5.1 SUBSTITUTION OF THE CUVETTE HOLDER ASSEMBLY MAGNET

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure..**

1. Remove the reaction plate cover (Fig. 1).
2. Unscrew the four cross-bas fastening screws and remove the cross-bar (Fig. 1).
3. Unscrew the four anchored screws of the reaction plate module (Fig. 2).
4. Place the reaction plate vertically inside the instrument.
5. Remove the magnet's two fastening screws (Fig. 7).
6. Remove connector J6 from the Reaction Plate Interface board (Fig. 2).
7. Remove the magnet and substitute it with the new one.
8. Remount, repeating the above steps, 6 through 1, in reverse order.

6.5.5.2 SUBSTITUTION OF THE CUVETTE HOLDER ASSEMBLY OPTO SENSOR

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure.**

1. Remove the reaction plate cover (Fig. 1).
2. Remove connector J5 from the Reaction Plate Interface board (Fig. 2).
3. Remove the optic sensor's two fastening screws and substitute it with the new one (Fig. 7).
4. Remount, repeating the above steps, 3 through 1, in reverse order.
5. After substituting and remounting, carry out the mechanical adjustment procedures as described in section 6.5.5.3

6.5.5.3 ADJUSTMENT AND FUNCTIONAL CHECK OF THE CUVETTE HOLDER MAGNETIC TRIGGER

- **N.B.: Make sure the instrument (Liasys) is turned off before performing this substitution procedure.**

1. Loosen the screw on the cuvette holder trigger (Fig. 7).
2. Rotate the reaction plate in such a manner as to position the trigger between two cuvettes (Fig. 8).
3. Manually push the pin toward the center of the solenoid - simulating magnetic attraction between the two.
4. Position the trigger in such a manner that the top edge is at the same height as the top edge of the cuvette. Tighten the cuvette holder trigger fastening screw (Fig. 8).
5. Turn on the "Liasys" system and launch the “Analyzer” program.
6. Launch the diagnostic program and select the "Plate" function.
7. Reset by clicking on the appropriate key. Make sure the "Home Sensor" Reaction Plate window lights up green.
8. Select the "Wash" function and reset by clicking on the appropriate key.
9. Make sure the "Home Sensor" Washing Station window lights up green.
10. Select "Home" and "Down" several times by clicking on the appropriate keys. Make sure the "Home Sensor" Cuv. Holder window lights up green when the washing station is in the "Home" position and lights up red when the washing station is in the "Down" position. If not, loosen the fastening screw on the opto sensor flag and adjust to obtain the correct signal (Fig. 7).
11. To exit the diagnostic program press the "Diagnostic" key.
12. To exit the analyzer program press “Shutdown” key.

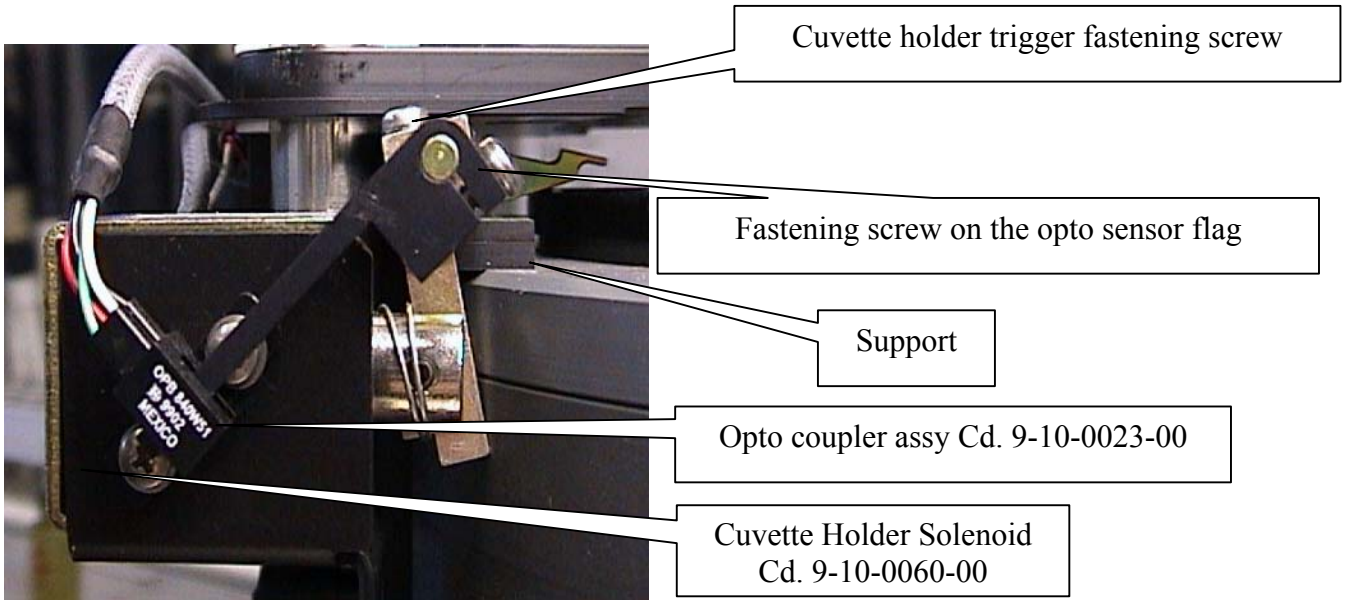


Fig. 7 Cuvette Holder

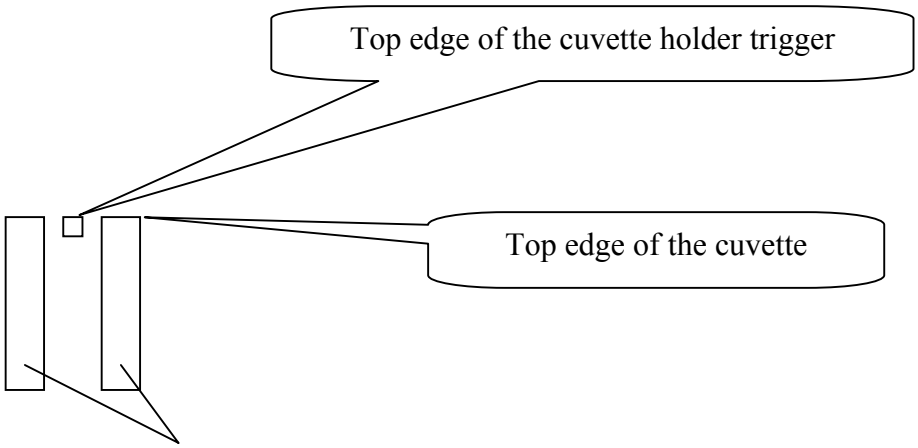


Fig. 8 Reaction cuvettes

6.6 TEMPERATURE CHECK AND ADJUSTMENT

6.6.1 REACTION CUVETTE TEMPERATURE ADJUSTMENT AND CHECK

1. Turn on the "Liasys" system and launch the “Analyzer” program. Wait approximately one hour in order to allow the instrument to reach temperature balance (at room temperature 20°). The warm-up time may vary from 30 minutes (at about 21° C room temperature) up to 100 minutes (at about 18° C room temperature).
2. Launch the diagnostic program and select the "Plate" function.
3. Carry out the cuvette # 16 in dispensation position.
4. Open the door and fill the cuvette # 1 with 50 microliters of distilled water.
5. Select “Configuration” function.
6. Digit the password (1234) in the appropriate window and press “OK”.
7. Insert the temperature probe (Model type Chemitec S 501 with probe ∅ max 0.9 mm) inside cuvette #1, from the door, until it touches the bottom of the cuvette.
8. Make sure the temperature read, after 5 – 10 minutes, is 37.0 °C – 0.2 + 0.3. If not, move the cursor within the "Plate" window to select the desired temperature and then click on "Save" to memorize said temperature.

N.B.: counts increase correspond to temperature decrease.
counts decrease correspond to temperature increase
<u>seven counts correspond to about one degree centigrade</u>.

9. Remove the temperature probe from the cuvette and empty it.
10. Repeat the procedure from point 3 to 9 using in sequence cuvette # 16, 31, and 46.
11. To exit the diagnostic program press the "Diagnostic" key.
12. Carry out the "Glucose" test on seven samples using distilled water for sample and reagent.
13. Press, "Start" and once the seventh sample has been dispensed, press "Stop". Wait the sound signal from the analyzer, that means the actual stop.
14. Insert the temperature probe all the way to the bottom of the cuvette in which the sampling probe is dispensing. Make sure the temperature registered is 37.0 °C – 0.2 + 0.3.
15. If not, launch the “Diagnostic” program and select the "Configuration" function.
16. Digit the password (1234) in the appropriate window and press “OK”.

17. Move the cursor within the "Heater" window to select the desired temperature and then click on "Save" to memorize said temperature.
18. Remove the temperature probe from the cuvette and exit from the “Diagnostic” program.
19. Carry out a washing cycle from “Start Work” mask in order to clean the cuvette.
20. **To exit the “Analyzer” program press “Shutdown” key.**

N.B.: counts increase correspond to temperature decrease. **counts decrease correspond to temperature increase** **seven counts correspond to about one degree centigrade.**

6.6.2 TEMPERATURE CHECK AND ADJUSTMENT USING KIT P/N 55-01204-00

IMPORTANT NOTICE
BEFORE APPLYING THE FOLLOWING PROCEDURE (PO 55-01204-00).

CHECK WHETHER THE INTEGRATED **CHIP “TL O71xxx”** IS INSTALLED ON THE “**CONTROL PANEL BD. – POS. U2** (see fig. 1)” AND REPLACE IT WITH THE INTEGRATED **CHIP “LMC 7101 A or B or TVL 2461 cp.”**

Temperature check and adjustment

This document describes how to adjust and check the pre-heater and plate temperature of the Instrument System.

1. Training:

- Service Engineers must be trained on the use, maintenance and main operations of Instrument System as well as on others tools involved in this procedure.

2. Summary:

CHECK WHETHER THE INTEGRATED CHIP “TL O71xxx” IS INSTALLED ON THE “CONTROL PANEL BD. – POS. U2 (see fig. 1)” AND REPLACE IT WITH THE INTEGRATED CHIP “LMC 7101 A or B or TLV 2461 cp.” BEFORE APPLYING THE FOLLOWING PROCEDURE.

- Turn on the system and wait in order to allow the instrument working temperature settlement. The warm-up time may vary from 30 minutes (at about 21° C room temperature) up to 100 minutes (at about 18° C room temperature).

- Calibrate the temperature probe by using the A and B resistors

- Put 300 µL (approx.) of distilled water PRE-WARMED at 37.0 ÷ 37.3°C into the cuvettes # 45 and 46

- Measure the temperature into the cuvettes # 45 and 46 to get an **indication** on the plate temperature

- Launch the temperatures test from the "Temperature" folder inside the "Diagnostic" program in order to **measure** and/or **slightly adjust them**

3. Special tools:

KIT FOR TEMPERATURE ADJUSTMENT P/N 55-01204-00 composed by the following items:

- Temperature probe
- Calibrator Resistor A (10 KΩ)
- Calibrator Resistor B (5,76 KΩ)

4. Procedure description:

With a thermostatic bath**, heat 250 ÷ 500 mL of distilled water up to 37-37.5°C (see page #3 if a thermostatic should be not not available).**

CHECK WHETHER THE INTEGRATED CHIP "TL O71xxx" IS INSTALLED ON THE "CONTROL PANEL BD. – POS. U2 (see fig. 1)" AND REPLACE IT WITH THE INTEGRATED CHIP "LMC 7101 A or B or TLV 2461 cp." BEFORE APPLYING THE FOLLOWING PROCEDURE.

- Turn on the system and wait in order to allow the instrument working temperature settlement. The warm-up may vary from 30 minutes (at about 21° C room temperature) up to 100 minutes (at about 18° C room temperature).

- During warm-up time, remove the protection cover of the Control Panel Board (Front Side Light Indicators) (See fig. 1).

- During warm-up time, launch the "Diagnostic" program and then select the "Temperature" Folder in the "Diagnostic" Program

- During warm-up time, select Calibration Sensor and carry out the three steps by following the indications showed on the screen.

- Replace the calibration resistor with the temperature probe.

Note 1: Now the temperature probe and the service probe function can be used as a thermometer.
Then route the temperature probe tip through the small door for cuvettes replacement. (See fig. 2)

To avoid the temperature probe damage be sure that its wires do not interfere with the reaction plate rotation.

By executing the reaction plate Reset, the cuvettes # 45 and 46 will be accessible through the small door so allowing the following operations:

a. Pre-warm the micropipette tip by repeatedly aspirating and dispensing the liquid from/into the 250-500 ml container. Put 300 µL (approx.) of distilled water (pre-warmed at 37.0÷37.3°C into the cuvettes # 45 and 46.

b. Wait 2-3 minutes then enter in the "Temperature" Folder and select "Temp. Test Run".

c. Measure the temperature by dipping and gently shaking the temperature probe into the liquid in the cuvettes.

d. Take note about the measured temperatures.

Note 2: The reaction plate temperature must be set at 37.0 ÷ 37.2 °C

e. If necessary, modify the value in the PLATE parameter field, (Configuration Folder in the Diagnostic Program) by taking into account that:

7 COUNTS CORRESPOND TO ABOUT 1°C

If the difference should be higher than 2°C, wait a few more minutes and repeat steps a.-b.-c.-d.-e.

f. Close the main cover and after having checked the correct setting of the reaction plate temperature, select Temp. Test Run in the Temperature Folder inside the Diagnostic program.

g. Verify that the temperature probe or others tools are correctly positioned so to avoid their interference with the moving parts of the instrument. During this procedure step in fact, the Sampling arm, the washing Station and the Reaction Plate will become active.

h. By pressing START, the system will sample seven reaction cuvettes in sequence

i. At the end of the sampling cycles, the main cover will be unlocked.

j. Open the small door for cuvettes replacement. Measure and take note of the cuvettes temperature starting from the seventh up to the first cuvette by dipping and gently shaking the temperature probe into the liquid.

k. At the end of measurements, press WASH. The system is ready for a new cycle.

Note 3: The measure obtained from the seventh cuvette is the best indication of the pre-heater temperature. The measure obtained on the first cuvette is the nearest to the reaction plate temperature (previously adjusted to 37.0 ÷ 37.2 °C). The objective is to obtain the same temperatures into all the seven cuvettes (37° - 37.2°C).

l. If necessary, modify the value in the ARM parameter field, (Configuration Folder in the Diagnostic Program) by taking into account that:

7 COUNTS CORRESPOND TO ABOUT 1°C

m. After any modification in the Parameter values repeat the steps from "f" through "k".

n. At the end of the adjustment procedure, get out from the Diagnostic Program and from the Instrument software, execute a WASH cycle then followed by the WBL.

Further information:

The reaction plate has been studied in order **to maintain the dispensed liquids at the set temperature and not to heat them up.**

Consequently it is really important to adjust the pre-heater temperature as much as possible near to the reaction plate temperature value (37.0 ÷ 37.2 °C).

If a thermostatic bath should be not available, **then apply the following**:

CHECK WHETHER THE INTEGRATED CHIP "TL O71xxx" IS INSTALLED ON THE "CONTROL PANEL BD. – POS. U2 (see fig. 1)" AND REPLACE IT WITH THE INTEGRATED CHIP "LMC 7101 A or B or TLV 2461 cp." BEFORE APPLYING THE FOLLOWING PROCEDURE.

- Turn on the system and wait in order to allow the instrument working temperature settlement. The warm-up may vary from 30 minutes (at about 21° C room temperature) up to 100 minutes (at about 18° C room temperature).
- During warm-up time remove the protection cover of the Control Panel Board (Front Side Light Indicators). (See fig. 1)
- During warm-up time, launch the diagnostic program and select the Temperatures Folder in the Diagnostic Program
- During warm-up time, select Calibration Sensor and carry out the three steps by following the indications showed on the screen
- Replace the calibrator resistor with the temperature probe.

Note 1: Now the temperature probe and the service probe function can be used as a thermometer. Route the temperature probe tip through the small door for cuvettes replacement.(See fig 2)

To avoid the temperature probe damage, to be sure its wires do not interfere with the reaction plate rotation.

1. Verify that the temperature probe or others tools are correctly positioned so to avoid their interference with the moving parts of the instrument. During this procedure step in fact, the Sampling arm, the washing Station and the Reaction Plate will become active.
2. Select Temp. Test Run in the Temperature Folder inside the Diagnostic program.
3. By pressing START, the system will sample seven reaction cuvettes in sequence
4. At the end of the sampling cycles, the main cover will be unlocked.
5. **Wait 10 minutes**, open the main cover and the small door for cuvettes replacement. Measure and take note of the cuvettes temperature starting from the third up to the first cuvette by dipping and gently shaking the temperature probe into the liquid.
6. At the end of the measurements, press WASH. The system is ready for a new cycle.

Note 2: In this case, cuvettes 1 through 3 can give a good indication of the reaction plate temperature.

7. If necessary, modify the value in the PLATE parameter field, (Configuration Folder in the Diagnostic Program) by taking into account that:

7 COUNTS CORRESPOND TO ABOUT 1°C

8. After any modification in the Parameter values repeat the steps from step “1” through “7”.

9. Close the main cover and after having checked the correct setting of the reaction plate temperature, select Temp. Test Run in the Temperature Folder inside the Diagnostic program.
10. Verify that the temperature probe or others tools are correctly positioned so to avoid their interference with the moving parts of the instrument. During this procedure step in fact, the Sampling arm, the washing Station and the Reaction Plate will become active.
11. By pressing START, the system will sample seven reaction cuvettes in sequence
12. At the end of the sampling cycles, the main cover will be unlocked.
13. Open the small door for cuvettes replacement. Measure and take note of the cuvettes temperature starting from the seventh up to the first cuvette by dipping and gently shaking the temperature probe into the liquid.
14. At the end of measurements, press WASH. The system is ready for a new cycle.

Note 3: The measure obtained from the seventh cuvette is the best indication of the pre-heater temperature. The measure obtained on the first cuvette is the nearest to the reaction plate temperature (previously adjusted to 37.0 ÷ 37.2 °C). The objective is to obtain the same temperatures into all the seven cuvettes (37° - 37.2°C).

15. If necessary, modify the value in the ARM parameter field, (Configuration Folder in the Diagnostic Program) by taking into account that:

7 COUNTS CORRESPOND TO ABOUT 1°C

16. After any modification in the Parameter values repeat the steps from “7” through “14”.
17. At the end of the adjustment procedure, get out from the Diagnostic Program and from the Instrument software, execute a WASH cycle then followed by the WBL.

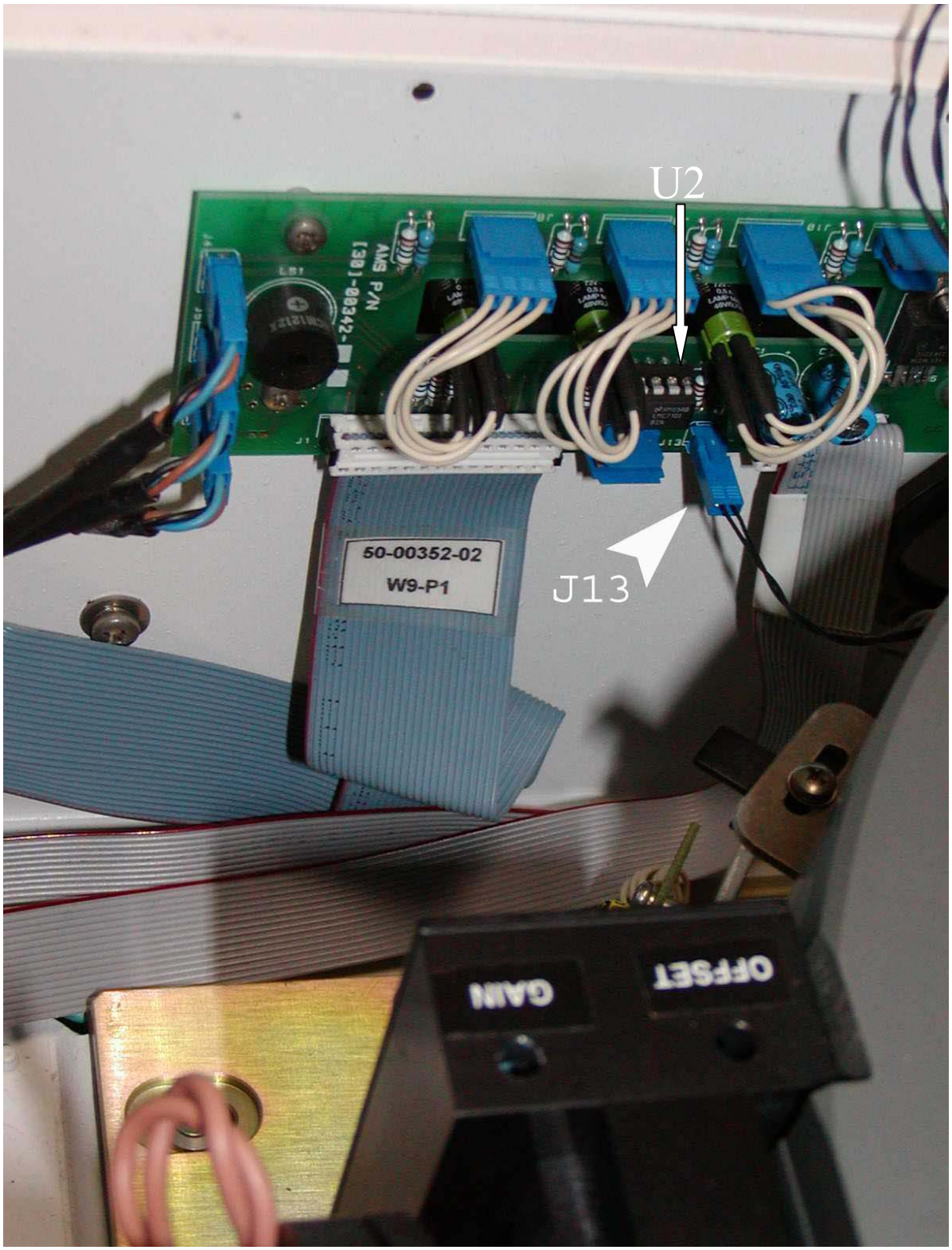


Fig.1

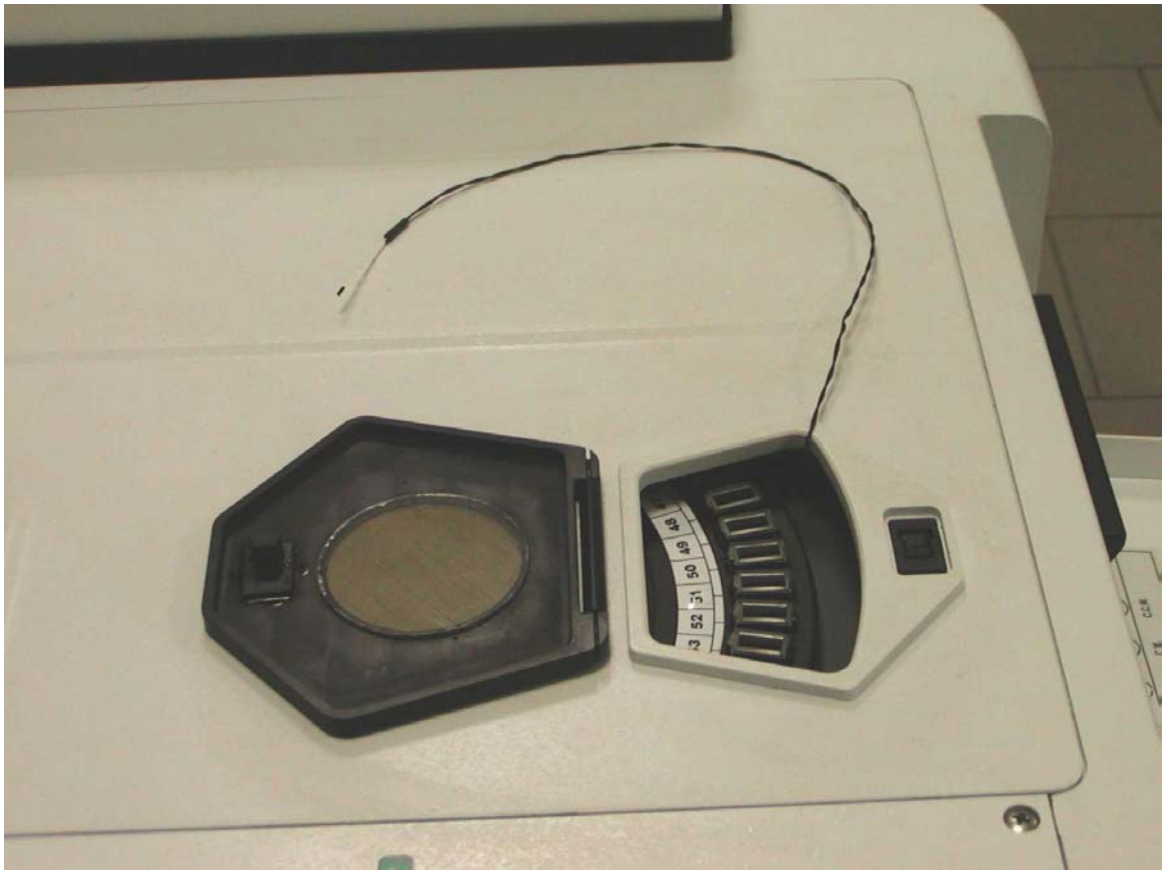


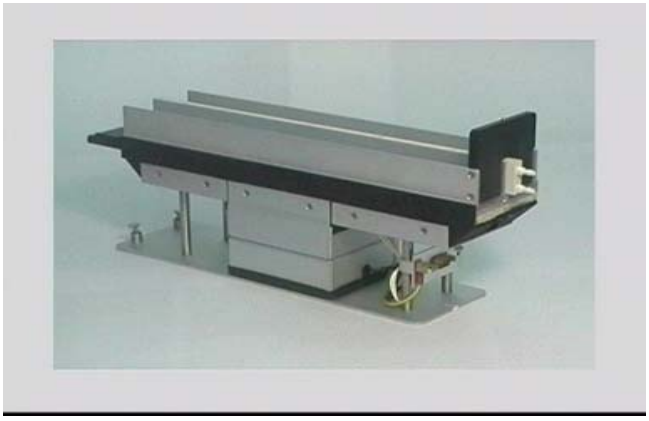
Fig. 2

6.6.3 REFRIGERATION ASSEMBLY TEMPERATURE CHECK

Warning: Keep the cooling fan protection grid, placed at the bottom of the refrigerated rack, unencumbered and free of dust.

1. Place a reagent container containing distilled water in a position of the refrigerated reagents rack.
2. Turn on the "Liasys" system (instrument and computer).
   Wait approximately one hour in order to allow the instrument to reach temperature balance (at room temperature 20° C).
3. Place the temperature probe in the reagent container and check that the temperature is approximately 10°C lower than room temperature. If not, substitute the reagents racks holder (Fig. 1).
4. Remove the reagent container containing distilled water and exit from the analyzer program press “Shutdown” key.

Fig. 1



Refrigerated Reagent Rack assembly Cd. 9-15-0024-00

6.7 RACKS HOLDER ALIGNMENT

6.7.1 MECHANICAL ALIGNMENT OF THE SAMPLES RACKS HOLDER

Warning: A check of the mechanical alignment of the samples racks must be performed every time a rack is removed (either for servicing or substitution).

N.B.: Make sure the instrument (Liasys) is turned off before performing this procedure.

1. Open the two front panels and remove the samples and STAT racks.
2. Remove the top cover of the samples (Fig.1).
3. Loosen the four fastening screws on the samples racks holder (Fig. 2).
4. Replace the top cover of the samples. Place empty samples cups in the first and last positions of the racks and reinsert the racks.
5. Align the holes of the caps with those of the top cover of the samples.
6. Once again, remove the top cover of the samples, remove the racks and tighten the fastening screws of the samples racks holder.
7. Reposition the racks and replace the top cover of the samples.
8. Close the two front panels.

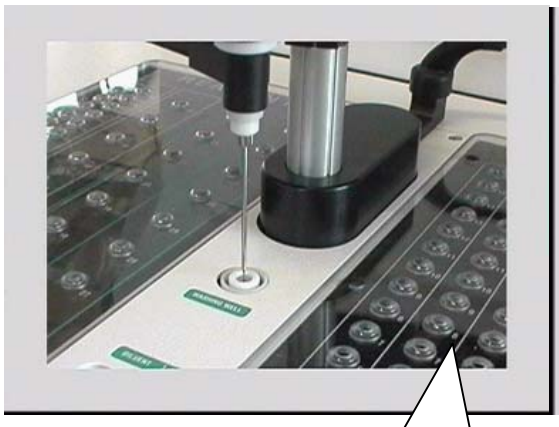


Fig. 1

top cover of the samples

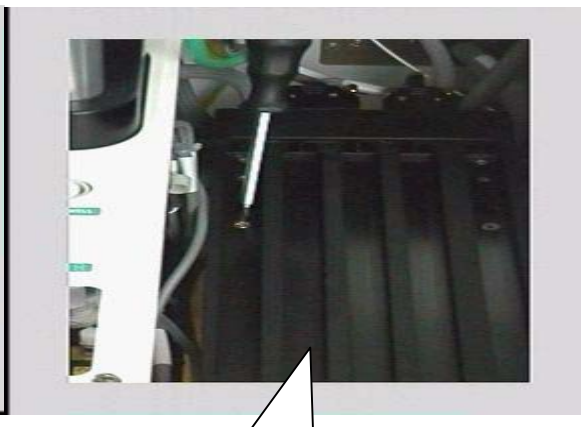


Fig. 2

Samples racks holder

6.7.2 MECHANICAL ALIGNMENT OF THE REAGENTS RACKS HOLDER

Warning: A check of the mechanical alignment of the reagents racks must be performed every time a rack is removed (either for servicing or substitution).

N.B.: Make sure the instrument (Liasys) is turned off before performing this procedure.

1. Open the front panel and remove the reagents racks.
2. Remove the top cover of the reagents (Fig. 1).
3. Loosen the four fastening screws on the reagents racks holder (Fig. 2).
4. Replace the top cover of the reagents. Place empty reagents cups in the first and last position of the racks and reinsert the racks.
5. Align the holes of the reagents containers with those of the top cover of the reagents.
6. Once again, remove the top cover of the reagents, remove the racks and tighten the fastening screws of the reagents racks holder.
7. Reposition the racks and replace the top cover of the reagents .
8. Close the front panel.

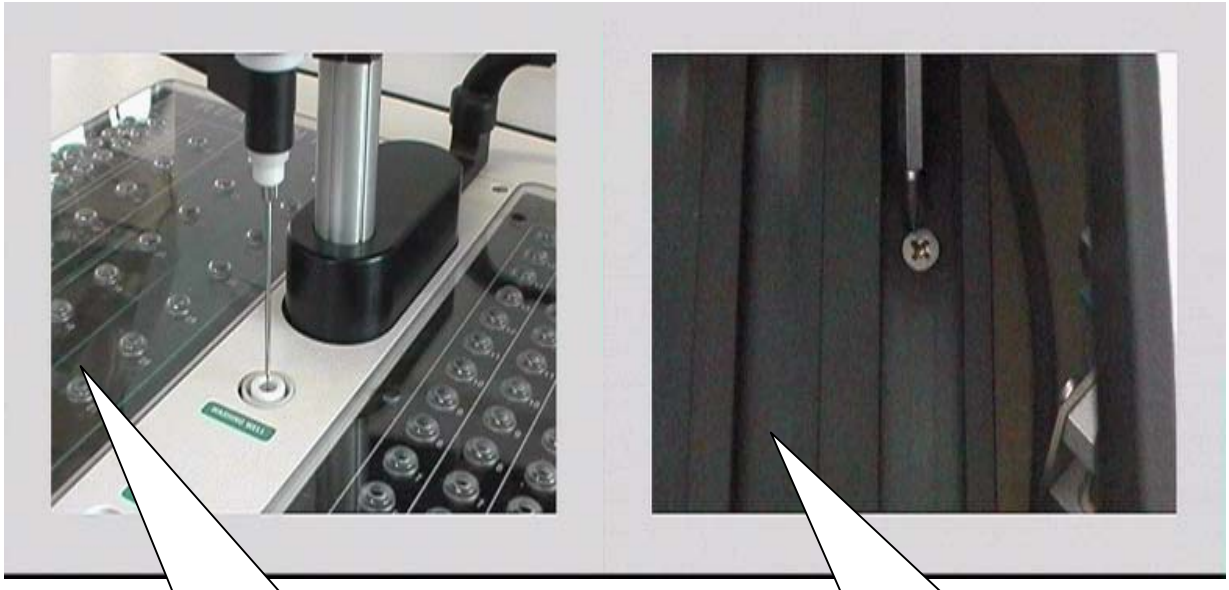


Fig. 1

Fig. 2

CHAPTER 07

- MAINTENANCE –

INDEX

7. MAINTENANCE…….2
7.1 PREVENTIVE MAINTENANCE……2
7.2 LIST OF PARTS SUBJECT TO WEAR AND USAGE……..4
7.3 SAMPLING PROBE - CLEANING PROCEDURE……4
7.4 WASH STATION CANNULAS - CLEANING PROCEDURE..……..……..5
7.5 WASH SOLUTION BOTTLES - CLEANING……..……..5
7.5.1 WASH SOLUTION BOTTLES - CLEANING PROCEDURE……...……6
7.6 TIP WASHING ……...…….....6
7.6.1 TIP - CLEANING PROCEDURE……..……..7
7.6.2 PROCEDURE FOR REPLACING THE TIP…….11
7.7 HYDRAULIC CIRCUIT WASHING ……...……..…..……..12
7.7.1 HYDRAULIC CIRCUIT - CLEANING PROCEDURE…….……..…..12
7.8 CHANGING THE PERISTALTIC PUMP TUBES…….……..…13
7.8.1 PROCEDURE FOR REPLACING THE PERISTALTIC PUMP TUBES……..…...13
7.9 CHANGING THE PHOTOMETER LAMP…….. 15
7.9.1 PROCEDURE FOR REPLACING THE PHOTOMETER LAMP…….….. 15
7.10 CHANGING THE REACTION CUVETTES…….…….. 16
7.10.1 PROCEDURE FOR REPLACING THE REACTION CUVETTES……..……16
7.11 CHANGING THE TUBES KIT……..16
7.11.1 PROCEDURE FOR REPLACING THE TUBES KIT……..……...…..16
7.12 TABLE C – LIST OF THOSE MAINTENANCE PROCEDURES THAT CAN BE PERFORMED BY THE USER AND/OR BY THE MAINTENANCE TECHNICIAN ……17
7.13 DECONTAMINATION PROCEDURE…….19

7 MAINTENANCE

This chapter contains all those routine operations, which concern instrument maintenance. Said procedures, listed and described below, should be carefully and scrupulously followed in order to guarantee the manufacturer's specifications and the perfect working order of the instrument over time.

7.1 PREVENTIVE MAINTENANCE

MAINTENANCE SCHEDULE

Table A, illustrated below, lists all those procedures to be carried out by the user/operator and the relative frequency schedule. Strict adherence to said schedule will guarantee the optimal operative efficiency of the instrument.

TABLE A – MAINTENANCE SCHEDULE

FREQUENCY	PROCEDURE	NOTES
DAILY – Before launching "Start Work"	Check the levels of all the wash solutions (Rinse, Water and Cleaning)	See Table B
DAILY – Before launching "Start Work"	Check the levels of Reagents, Standards and Controls	See Table B
DAILY – Before launching "Start Work"	Check the levels of the Waste Bottles and, if necessary, empty them	
DAILY – Before launching "Start Work"	Carry out a WBL cycle	See the User's Manual, Chapter 03– Description of Instrument Software
DAILY – After Shutdown	Clean the Sampling Probe using either paper toweling or gauze	See Procedure 7.3

TABLE A – MAINTENANCE SCHEDULE

FREQUENCY	PROCEDURE	NOTES
EVERY TWO WEEKS	Clean the Wash Station's four cannulas	See Procedure 7.4
EVERY TWO WEEKS	Clean the wash solution bottles (Rinse, Water and Cleaning)	See Procedure 7.5
ONCE A MONTH	Clean the Tip	See Procedure 7.6
ONCE A MONTH	Clean the Hydraulic Circuit	See Procedure 7.7
EVERY TWO MONTHS	Change the Reaction Cuvettes	See Procedure 7.10
EVERY SIX MONTHS	Change the Peristaltic Pump Tubes	See Procedure 7.8
EVERY SIX MONTHS	Change the Tip	See Procedure 7.6
ONCE A YEAR	Change all the tubes (Tube Kit)	See Procedure 7.11
EVERY 2000 HOURS	Change the Photometer lamp	See Procedure 7.9

- N. B.: the above-described maintenance schedule refers to that situation in which the workload of the *Analyzer* is approximately 500 tests per day. The interval frequency may vary according to the individual instrument's daily workload.

7.2 LIST OF PARTS SUBJECT TO WEAR AND USAGE

Description	**Type**	**Quantity**	**Code**
Reagents bottle	40 ml	30 pieces	9-65-0034-00
Reagents bottle	10 ml	25 “	AS-650121
Glass reagent bottle	7 ml	10 “	AS-900020
Reagents bottle	2 ml	25 “	AS-650122
Conical sample cups	2 ml	1000 “	AS-65-0001
Short sample cups	1 ml	1000 “	AS-65-0100
Washing solution bottle	2 lt	1 “	9-35-0041-00
Kit tubing peristaltic pump		2 “	9-65-0040-00
Reaction cuvettes		60 “	9-65-0031-00
Drying Pad		1 “	9-01-0038-00
Halogen Lamp		1 “	9-35-0016-00
Tubes Kit – complete		1 “	9-65-0027-01
Tygon tubing	1 mt.	1 “	90-01253-00
Kit for E.V.Diluter connection		1 “	99-00906-00
Probe		1 “	9-05-0064-00
Probe new coating		1 “	9-05-0064-01
Micro-Pump Assembly		1 “	9-10-0028-01
Complete Probe Assembly		1 “	9-10-0062-00
Comp Probe Assembly New C		1 “	9-10-0062-01
Diluter head Teflon Fitting		10 “	C1-01-0042-01
Diluter fitting		10 “	C1-01-01222-00
E.V. Rinse fitting		10 “	C190-01254-00
Solenoid Valve		1 “	F-35-0019-00
Micro-Pump (up4) Assy		1 “	05-00403-00
Micro-Pump (up2) Assy		1 “	05-00404-00
Micro-Pump (up3) Assy		1 “	05-00447-00
Manifold Assembly		1 “	05-00405-00
Inlet/Outlet fitting for rinse…		1 “	01-01224-00
Lamps kit		5 “	9-65-0035-00
Na electrode		1 “	35-00814-00
K electrode		1 “	35-00815-00
Cl electrode		1 “	35-00816-00
Reference electrode		1 “	35-00817-00
Peristaltic Pump Tubing-head		1 “	35-00830-00
ISE inlet tubing connection	6 mt	1 “	35-00831-00
Cleaning Solution	2 x 250 ml	1 piece	AS-RN-00-20

Rinse Solution	1 x 50 ml	1 piece	AS-RN-00-21

7.3 SAMPLING PROBE – CLEANING PROCEDURE

1) Turn off the *Analyzer*

2) Use only lint-free paper toweling or gauze

3) Dampen the gauze or paper toweling with distilled water and clean the outside of the sampling probe. Wipe the probe from the top downwards only! This is to avoid that any bits of cloth, paper or lint fibers accidentally enter the probe itself.

4) The manufacturer suggests that once weekly the above-described cleaning procedure be performed using, instead of only simple distilled water, a 5% sodium hypochlorite solution to dampen the gauze and then be repeated using distilled water.

7.4 WASH STATION CANNULAS – CLEANING PROCEDURE

1) Turn off the *Analyzer*.

2) Place a sheet of paper under the wash station cannulas in order to keep any extraneous material from accidentally falling into the cuvettes.

3) Use only lint-free paper toweling or gauze.

4) Dampen the gauze or paper toweling with distilled water and clean the outside of the cannulas. Wipe the cannulas from the top downwards only! This is to avoid that any bits of cloth, paper or lint fibers accidentally enter the cannulas themselves.

5) The manufacturer suggests that once weekly the above-described cleaning procedure be performed using, instead of only simple distilled water, a 5% sodium hypochlorite solution to dampen the gauze and then be repeated using distilled water.

7.5 WASH SOLUTION BOTTLES – CLEANING

During normal use and over time, mold and dust can build up inside the wash solution bottles. For this reason, it is extremely important that they be periodically washed. Said cleaning must be thorough and meticulous in order to insure that every trace of mold or residue be removed.

How often the bottles must be cleaned depends on their use and on the quality of the distilled water used in that particular laboratory. However, the manufacturer recommends thorough washing at least once every two weeks.

It is extremely important that the user not underestimate the risks associated with mold and dust particles. They are to be regarded as a serious hazard as they can be the cause of instrument malfunction.

The wash solution bottles are located on the right side of the analyzer.

7.5.1 WASH SOLUTION BOTTLES - CLEANING PROCEDURE

1) Turn off the *Analyzer*.

Pull the level sensor connectors out from the bottle caps.

2) Take the caps off the bottles and empty them.

3) Fill each bottle with a 5% sodium hypochlorite solution.

4) Clean the inside of each bottle using a bottlebrush in order to remove all traces of mold and/or residue.

5) Leave the sodium hypochlorite solution stand in the bottles for at least ten minutes.

6) Empty the bottles, rinse them repeatedly and well with tap water, and then twice more using distilled water.

7) Dry the bottles.

8) Fill the bottles with their proper solutions.

9) Replace the bottles in their respective housings.

10) Close the bottles and reconnect the level sensors.

11) Carry out two ‘Wash Cuvettes’ cycles and two ‘WBL’ cycles. Check system efficiency by comparing the WBL values and the test results obtained against the laboratory’s quality control values.

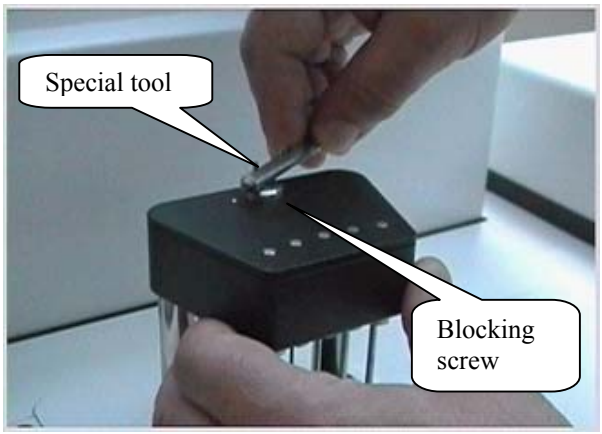
7.6 TIP WASHING

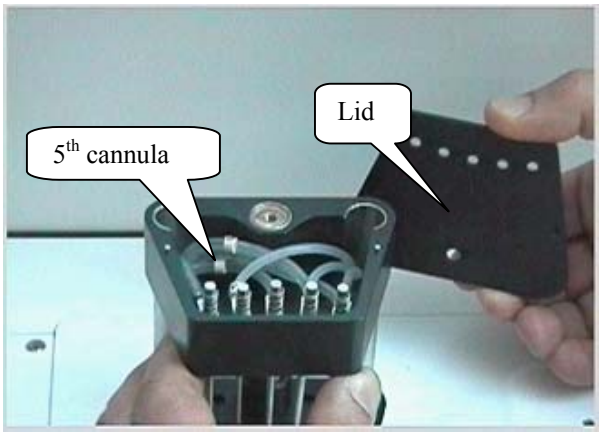
The Tip is used to dry the cuvettes after they have been washed. This drying process is carried out via aspiration and therefore, over time, the Tip will necessarily absorb various contaminating particles.
The manufacturer suggests that the Tip be replaced every six months. Said frequency may vary depending on the workload of the individual laboratory and the operating conditions/environment of the single instrument.
The Tip must be washed regularly in order to guarantee proper functioning and must be replaced with a new Tip as necessary.

7.6.1 TIP - CLEANING PROCEDURE

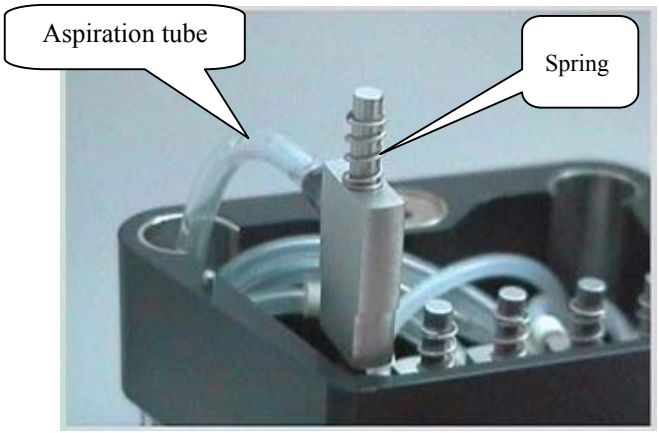
1. Turn off the *Analyzer*.

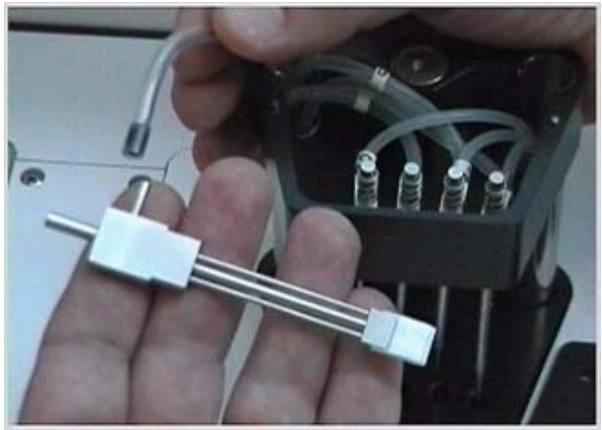
2. Remove the top cover (lid) of the Wash Station using the specific tool included among the instrument's accessories.



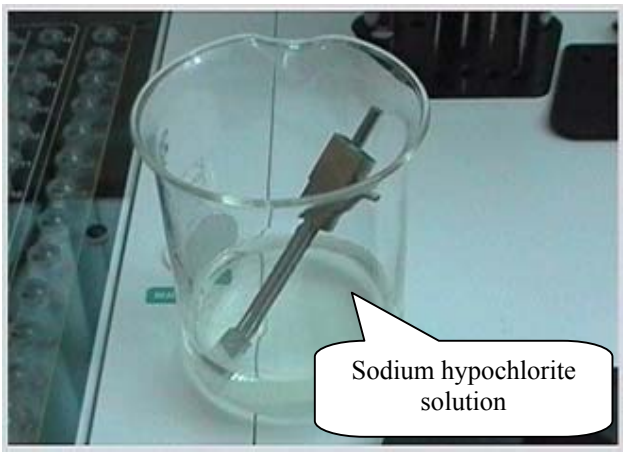


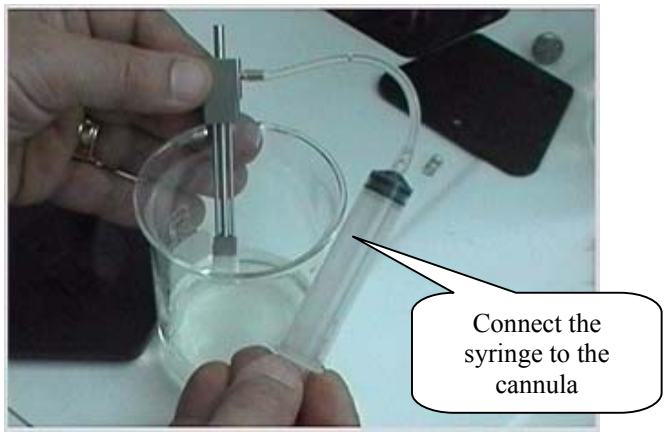
3. Remove the cannula that contains the Tip (the 5th cannula) and disconnect the aspiration tube
4. Remove the spring

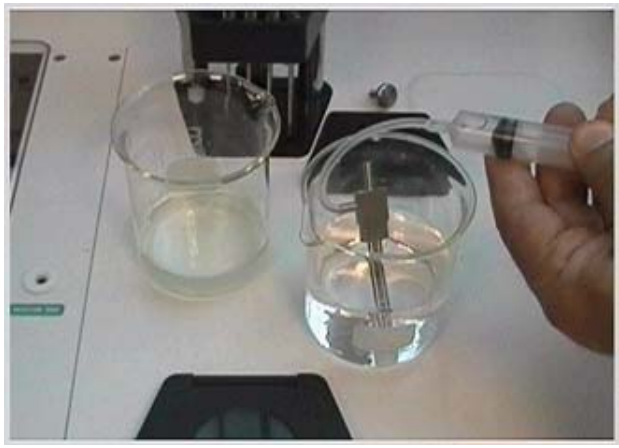




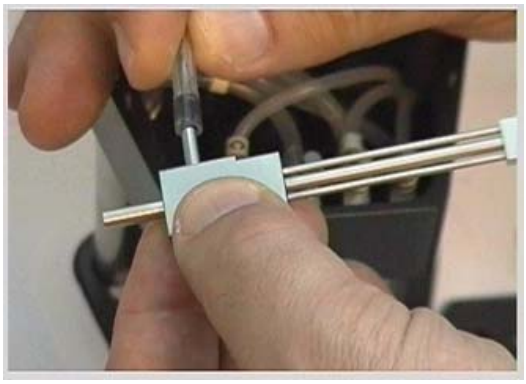
5. Once the cannula has been removed, immerge it in a 5% solution of sodium hypochlorite for at least 15 minutes.
6. Attach a 10 ml syringe to the cannula as illustrated in Figure 6.
7. Aspirate and dispense the hypochlorite solution through the cannula (and the Tip) until the latter is completely clean. This aspirating and dispensing forces the liquid through the Tip fibers in both directions. Please see Figure 7.







8. Once the Tip is clean, repeat the aspirating and dispensing cycle 10 more times using distilled water, then disconnect the syringe.

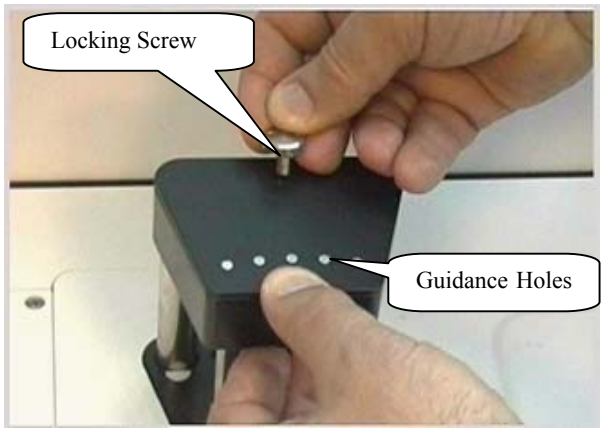


9. Re-connect the aspiration tube to the cannula

10. Re-position the cannula in its housing being careful to not kink the aspiration tube

11. Re-position the spring on the cannula's cylindrical axel

12. Close the lid, making sure that the cylindrical tops of the cannulas fit into the corresponding holes on the lid



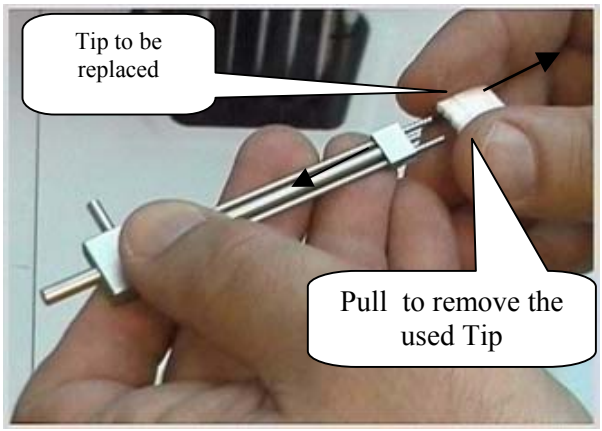
13. Insert the blocking screw into its setting and screw it down using the special tool included among the instrument's accessories

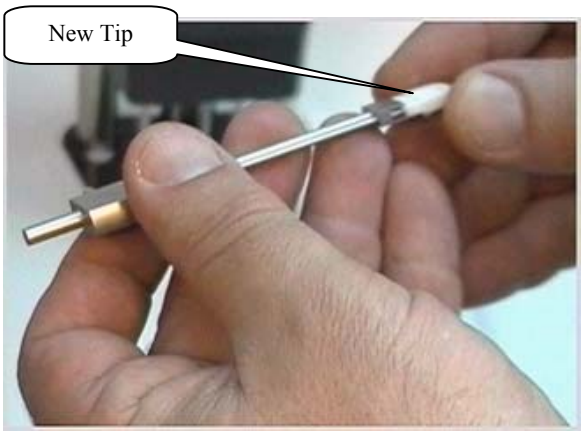
IMPORTANT: Before starting the instrument back up, manually move the wash station upwards as far as it will go.

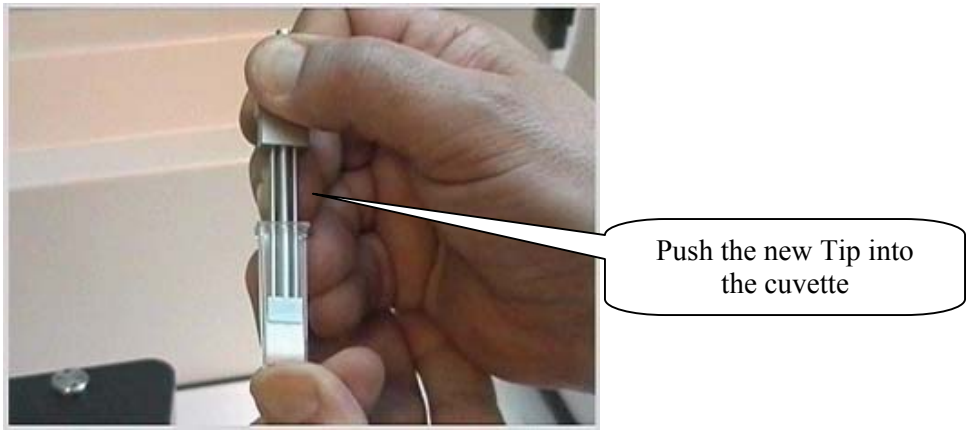
7.6.2 PROCEDURE FOR REPLACING THE TIP

1. Turn off the *Analyzer*.
2. Unscrew the screw that fastens the black top cover of the wash station, using the special tool included among the instrument's accessories.
3. Remove the wash station cover lid and take out the cannula containing the Tip. Be very careful to not lose the spring.
4. Disconnect the aspiration tube, remove the used Tip, and replace it with a new one. Press lightly to push the new Tip into place – be careful to not press too hard as this could deform the Tip.
5. Insert the cannula containing the new Tip into a cuvette, pushing it down inside until it takes on the shape of the inside of the cuvette.
6. Remove the cuvette, connect the aspiration tube to the cannula and reposition the cannula back into its proper housing in the wash station. Be careful to not kink the aspiration tube while doing so.
7. Reposition the spring in its proper housing. Remount the wash station coverlid making sure that the cylindrical tops of the cannulas fit into the corresponding holes on the wash station coverlid.

IMPORTANT: Before starting the instrument back up, manually move the wash station upwards as far as it will go.







7.7 HYDRAULIC CIRCUIT WASHING

During normal use and over time, mold and dust can build up inside the wash bottles and can have a negative effect on the hydraulic circuit, compromising the correct functioning of the micro-pump and valves. This, in turn, can lead to inefficiency in the sampling probe and cuvette washing system.

For this reason, it is extremely important that the hydraulic circuit be periodically washed. Said cleaning must be thorough and meticulous in order to assure that every trace of mold or residue be removed.

How often the hydraulic circuit must be washed depends on the operating conditions/environment of the single instrument and the quality of the distilled water used in that particular laboratory. The manufacturer recommends thorough washing at least once a month.

It is extremely important that the user not underestimate the risks associated with mold and dust particles. They are to be regarded as a serious hazard as they can be the cause of instrument malfunction.

The hydraulic circuit input cannulas are located inside the bottles on the right side of the *Analyzer*.

7.7.1 HYDRAULIC CIRCUIT - CLEANING PROCEDURE

1) Turn on the *Analyzer*.

2) Prepare a bottle containing 500 ml of a 5% sodium hypochlorite solution

3) Insert the three aspiration cannulas, located inside the liquids bottles, into the bottle containing the sodium hypochlorite solution.

4) Have the instrument carry out a ‘WBL’ cycle and then a ‘Wash cuvettes’ cycle.

5) Wait for fifteen minutes. Clean and dry the three cannulas and then insert them into a bottle containing distilled water.

6) Have the instrument carry out a ‘WBL’ cycle and then a ‘Wash cuvettes’ cycle.

7) Insert the three aspiration cannulas back into their respective bottles. Said bottles should have, in the meantime, been cleaned and filled with a fresh supply of the required solution.

8) Have the instrument carry out a ‘WBL’ cycle and then a ‘Wash cuvettes’ cycle. Check system efficiency by comparing the WBL values and the test results obtained against the laboratory’s quality control values.

7.8 CHANGING THE PERISTALTIC PUMP TUBES

The manufacturer recommends that the Peristaltic Pump tubes be replaced every six months. Said frequency may vary depending on the workload of the individual laboratory. The quality and reliability of these tubes is fundamental to a correct emptying of the cuvettes.

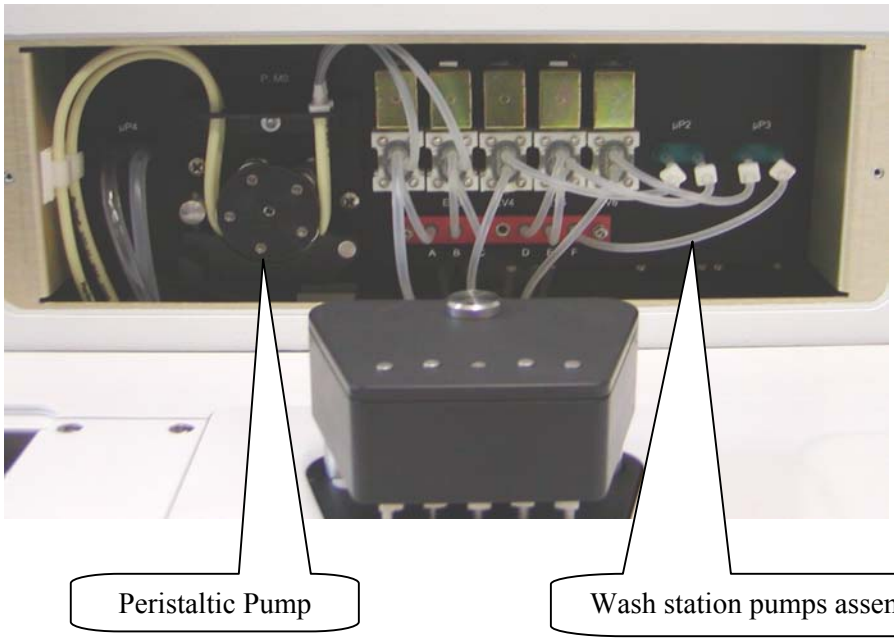
7.8.1 PROCEDURE FOR REPLACING THE PERISTALTIC PUMP TUBES

1) Turn off the *Analyzer*.

2) Remove the panel located behind the wash station (Fig. 1).

3) Unhook the hinged guide by lowering and rotating the guide's blocking bracket to the left (Fig. 2).

4) Once the hinged guide has been removed, pull the tubes out of their relative nipples.



5) Insert the new tubes into their relative nipples

6) Position the tubes around the peristaltic pump rotor.

7) Close back the hinged guide.

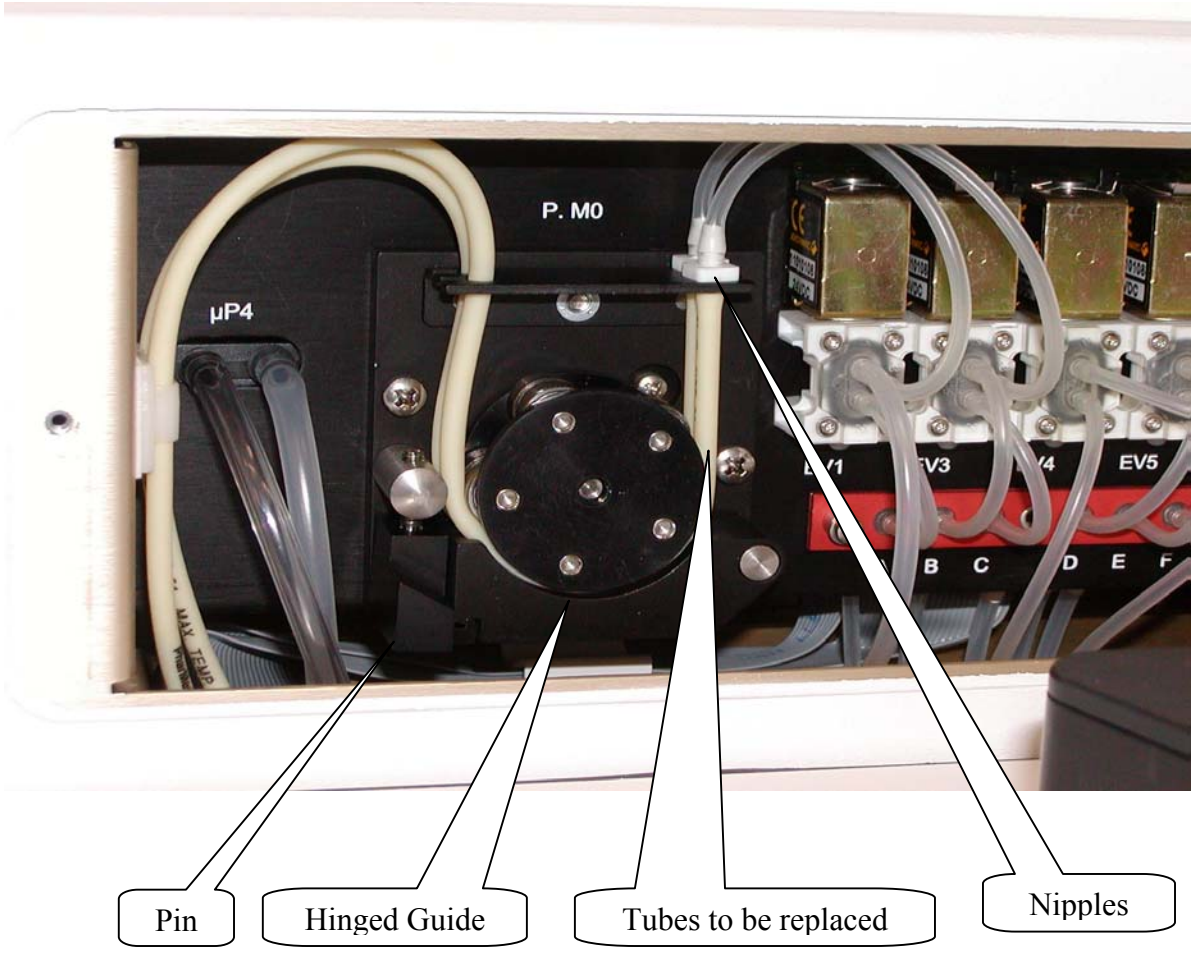
8) Manually rotate the peristaltic pump rotor clockwise and check to make sure that the tubes are correctly positioned inside the guide.

9) Turn on the *Analyzer* and wait until the instrument has reached its proper operating temperature.

10) Have the instrument carry out a 'Wash cuvettes' cycle and then a 'WBL' cycle. Check system efficiency by comparing the WBL values and the test results obtained against the laboratory's quality control values.

11) Make sure that there is no leakage and then close back the panel.

Fig.2



7.9 CHANGING THE PHOTOMETER LAMP

The manufacturer suggests that the lamp be replaced after approximately 2000 hours of use. Figure 3 illustrates the photometer lamp, its support base and its power supply wires. There is a small hole on the lamp base useful for its mechanical alignment. The lamp is mounted on the photometer, which is located on the right-hand side of the reaction plate.

7.9.1 PROCEDURE FOR REPLACING THE PHOTOMETER LAMP

1) Turn off the *Analyzer*.

2) Remove the reaction plate cover.

1) Disconnect the power supply wires from the Lamp Regulator Board by loosening the clamp screws on the M1 connector (Fig. 4).

4) Unscrew the lamp's fastening screw and remove the lamp from its housing (Fig. 4)

5) Replace the old lamp with a new one making sure that the pin is correctly inserted in the alignment hole (Fig. 4). Remount the assembly by repeating the above steps 4 through 1 in inverse order.

6) Turn the *Analyzer* on and wait until the instrument has reached its proper operating temperature.

7) Have the instrument carry out a 'WBL' cycle. Check system efficiency by comparing the WBL values and the test results obtained against the laboratory's quality control values.

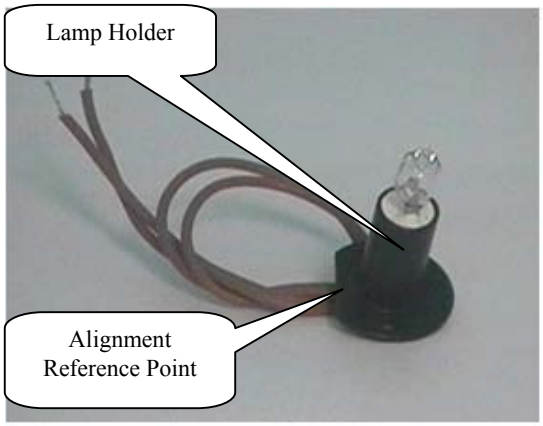


Fig.3

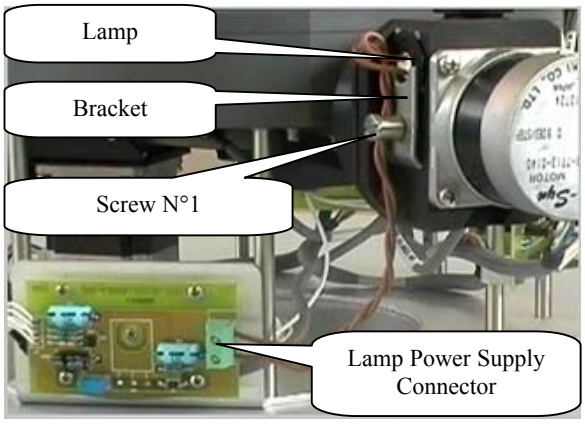


Fig.4

WARNING! DO NOT TOUCH THE GLASS PART OF THE LAMP WITH YOUR FINGERS!
IF NECESSARY, USE A CLEAN CLOTH TO REMOVE DUST, OR ALCOHOL TO REMOVE MORE STUBBORN DIRT.

7.10 CHANGING THE REACTION CUVETTES

Over time and through normal use the perfect transparency of the cuvettes diminishes. This less-than-perfect transparency has a negative impact on the quality of the optical readings. The manufacturer suggests that the cuvettes be replaced after two months of use. The cuvettes are located inside the reaction plate.

7.10.1 PROCEDURE FOR REPLACING THE REACTION CUVETTES

1. Turn on the *Analyzer* and wait until the instrument has reached its proper operating temperature.
2. Click on **"Change"**, located under the work program (Please see Chapter 03 – Description of Instrument Software).
3. A pull-down menu will appear. Click on **"Plate – First Half"** and then on **OK.**
4. A dialog box will appear asking: **"Do you want to change the cuvettes requested?"** Click on **OK** to confirm. Remove the reaction plate coverlid.
5. Remove the cuvettes numbered 1 through 30 by **VERTICALLY** lifting them out from their housing and then replace them with new cuvettes. Make sure to reinsert the new cuvettes **VERTICALLY**. Moreover, be especially careful to not touch the external surface of the cuvettes dedicated to photometric reading.
6. Select **"Plate – Second Half"** from the pull-down menu and then click on **OK**.
7. A dialog box will appear asking: **"Do you want to change the cuvettes requested?"** Click on **OK** to confirm.
8. Remove the cuvettes numbered 31 through 60 by **VERTICALLY** lifting them out from their housing and then replace them with new cuvettes. Make sure to reinsert the new cuvettes **VERTICALLY**. Moreover, be especially careful to not touch the external surface of the cuvettes dedicated to photometric reading.
9. Have the instrument carry out a 'WBL' cycle. Check system efficiency by comparing the WBL values and the test results obtained against the laboratory's quality control values.

7.11 CHANGING THE TUBES KIT

Over time and through normal use, the tubes become worn.

The manufacturer suggests that the tubes be replaced at least once a year. These tubes are located behind the panel situated behind the wash station.

7.11.1 PROCEDURE FOR REPLACING THE TUBES KIT

1) Turn off the *Analyzer*.
2) Remove the panel located behind the wash station.
3) Replace the tubes following the indications provided in the hydraulic diagram (SI 00457-00).
4) Turn on the *Analyzer* and wait until the instrument has reached its proper operating temperature.
5) Have the instrument carry out a 'Wash cuvettes' cycle and then a 'WBL' cycle. Make sure that there is no leakage.
6) Check system efficiency by comparing the WBL values and the test results obtained against the laboratory's quality control values.

7.12 TABLE C – LIST OF THOSE MAINTENANCE PROCEDURES THAT CAN BE PERFORMED BY THE USER AND/OR BY THE MAINTENANCE TECHNICIAN

PROCEDURE	FREQUENCY (*)	EFFECTUATED BY
CLEANING THE SAMPLING PROBE	DAILY	OPERATOR
CLEANING THE FOUR WASH STATION CANNULAS	EVERY TWO WEEKS	OPERATOR
CLEANING THE WASH SOLUTION BOTTLES	EVERY TWO WEEKS	OPERATOR
REPLACING REACTION CUVETTES	EVERY TWO MONTHS	OPERATOR
CLEANING THE TIP	ONCE A MONTH	OPERATOR
REPLACING THE TIP	AS NEEDED	OPERATOR
ALIGNING AND ADJUSTMENT OF THE SAMPLING ARM (Std&Ctr/Reagents/Samples/Dispensing)	AS NEEDED (e.g.: after replacing any mechanical part)	OPERATOR
REPLACING THE PERISTALTIC PUMP TUBES	EVERY SIX MONTHS	OPERATOR
REPLACING THE PHOTOMETER BULB	AFTER 2000 HOURS OF USE	OPERATOR
REPLACING THE SAMPLING PROBE	AS NEEDED	OPERATOR
REPLACING THE TUBES (Tubes Kit)	ONCE A YEAR	MAINTENANCE TECH

PROCEDURE	FREQUENCY (*)	EFFECTUATED BY
REPLACING THE PRE-HEATER AND THE SENSOR LEVEL	AS NEEDED	MAINTENANCE TECH
MECHANICAL ALIGNMENT OF THE SAMPLING ARM	AS NEEDED	MAINTENANCE TECH
REPLACING OR ADJUSTING THE OPTIC SENSORS	AS NEEDED	MAINTENANCE TECH
REPLACING THE BELT	AS NEEDED	MAINTENANCE TECH
REPLACING A MOTOR	AS NEEDED	MAINTENANCE TECH
ALIGNING THE WASH STATION/REACTION PLATE	AS NEEDED	MAINTENANCE TECH
ALIGNING THE CUVETTE BLOCK	AS NEEDED	MAINTENANCE TECH
REPLACING THE PHOTOMETER	AS NEEDED	MAINTENANCE TECH
ADJUSTING THE PHOTOMETER	AS NEEDED	MAINTENANCE TECH
REPLACING THE ELECTRONIC BOARDS/CARDS AND THE MECHANICAL MODULES	AS NEEDED	MAINTENANCE TECH

N. B.: the above-indicated frequency intervals may vary according to the individual instrument's daily workload.

7.13 DECONTAMINATION PROCEDURE

Before replacing any instrument parts, repairing any defective items or performing any instrument maintenance procedure(s), the operator or maintenance technician must carry out the below-described decontamination procedure of the instrument part(s) involved in the operation(s).

This procedure can be performed on:

- the entire *Analyzer*
- those part(s) of the instrument subject to possible contamination

Material necessary

- an *ESOFENOL* solution diluted to 6% (60 cc in one liter of distilled water). *ESOFENOL* is an antibacterial and antiviral substance.
- Rubber gloves
- Mask
- Lab coat

External surfaces and individual parts

➔ Spray the solution all over the instrument, paying particular attention to wetting:
  - the sampling arm
  - the reaction plate (including the cuvettes)
  - the racks
  - the instrument chassis

➔ Allow the solution to stand for approximately 30 minutes
➔ Wipe the solution off the instrument and the various components using a sponge dampened with distilled water

Carry out a decontamination of the internal hydraulic circuit.

Hydraulic circuit (Entire Instrument)

➔ Fill a container with a 5% sodium hypochlorite solution.
➔ Disconnect the three silicon aspiration tubes from the nipples on the caps of their respective tanks.
➔ Immerge all three tubes into the container filled with the 5% sodium hypochlorite solution and have the instrument carry out two 'Wash cuvettes' cycles and then two 'WBL' cycles.
➔ Remove the three tubes from the 5% sodium hypochlorite solution and immerge them in another container containing the instrument Rinse Solution.
➔ Have the instrument carry out one 'Wash cuvettes' cycle and then one 'WBL' cycle.
➔ Reconnect the three aspiration tubes to the nipples on their respective tanks.

CHAPTER 08

– HOST COMMUNICATION –

INDEX

8.1 COMMUNICATION WITH THE HOST COMPUTER 2

8.1.1 COMMUNICATION PARAMETERS 2

8.2 PROTOCOL SPECIFICATIONS 3

8.3 HEADER RECORD (H) 4

8.4 PATIENT RECORD (P) 5

8.5 TEST ORDER RECORD (O) 8

8.6 RESULTS RECORD (R) 11

8.7 MESSAGE TERMINATOR RECORD (L) 13

8.8 REQUEST INFORMATION RECORD (Q): 13

8.1 COMMUNICATION WITH THE HOST COMPUTER

The *Liasys* can be connected to a host computer for the purpose of facilitating results print-out and patient management.

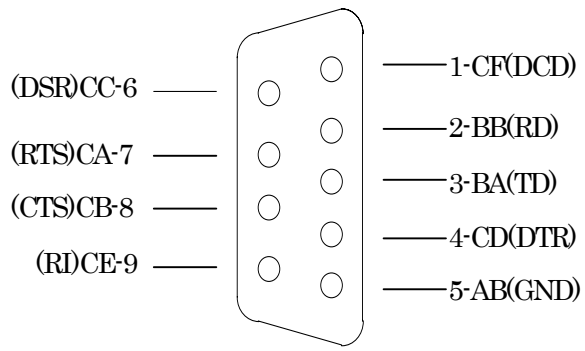
In order to enable communication between the *Liasys* and the host computer, select the **Host Link** field under **Options** in the **Parameters** menu.

To activate communication between the *Liasys* and the host computer, select **Host–Tx** (please see the software description in Chapter 03 of the User's Manual)

8.1.1 COMMUNICATION PARAMETERS

The *Liasys* is linked to the managing computer using an RS-232C serial connector having the following specifications:

- Transmission method : Asynchronous, half duplex
- Baud Rate : 9600 Bit/sec.
- Data bits: : 8
- Parity : None
- Stop bit : 1
- Connector : 9 pin type D (male output from the Liasys)



Serial connector

8.2 PROTOCOL SPECIFICATIONS

This part of Help (**Protocol Specifications**) contains information for the laboratory computer and analyzer. This exchange of data follows specific **ASTM** protocols:

> **E 1381-95** Standard Specification for Low-Level Protocol to Transfer Messages between Clinical Laboratory Instruments and Computer Systems;
> **E 1394-97** Standard Specification for Transferring Information between Clinical Instruments and Computer Systems.

ASTM uses a number of different terms to indicate the way it groups data.

- **Field:** an individual piece of data often referred to as a data field or a data element.
- **Record:** a number of logically related data fields grouped together to form one part of a complete message.
- **Repeat field:** a data field of the same type as the one immediately preceding it. A delimiter separates one instance of a repeat field from the next.
- **Component field:** part of data field that might contain more than one piece of data.

The default communication configuration for the *Analyzer* is the following: **"9600,N, 8,1"**.

ASTM uses record types that are common and familiar to all laboratory personnel. It uses the following record types:

- **Header Record (H):** contains identifying information about the sending station, conventions that the device uses for field recognition, and the date and time of send station transmission.
- **Patient Record (P):** contains patient information and identification number.
- **Test Order Record (O):** contains information about the assay or requests themselves and includes other data.
- **Result Record (R):** contains information about the outcome of individual tests for an individual patient and follows a sample program record. The results contain the actual measurements derived from the test and a comparison of the individual result to certain ranges specified as norms for the laboratory.

- **Message Terminator Record (L):** although the ASTM protocol supports three additional record types - a Request for Information Record, a Scientific Record and a Manufacturer's Information Record - the *Analyzer* is not implementing these in the first release and will ignore them.
- **Request Information Record (Q):** is used by either clinical instruments or computer systems for a remote request for information from its reciprocal system.

The instrument does not send or accept comment records.

8.3 HEADER RECORD (H)

Field	Field Title	Down Load	Up Load	Max Len	Description and Valid Values
1	Record Type ID	**R**	**A**	1	This is a required field that contains an "H" identifying it as a header record.
2	Delimiters	**I**	**A**	4	The *Analyzer* System uses only the four default values shown here. Delimiters may not be duplicated. The field delimiter follows the escape character to separate the delimiter specification from a subsequent field in the header record. Using default values, the first six characters of the header record will appear using the following characters: H I\^&I Field Delimiter I Repeat Delimiter \ Component Delimiter ^ Escape Delimiter &
3	Message Control ID	**I**	**N**		
4	Access Password	**I**	**N**		
5	Sender Name or ID	**I**	**A**	**10**	'SHAnalyzer': This is the name of the device that is sending the data.
6	Sender Street Address	**I**	**N**		
7	Reserved Field	**I**	**N**		

8	Sender Tel. Number	**I**	**N**		
9	Characteristics of Sender	**I**	**N**		
10	Receiver ID	**I**	**N**		
11	Comments or Special Instructions	**I**	**N**		
12	Processing	**I**	**N**		
13	**ASTM** Version No.	**I**	**N**		
14	Date and Time	**I**	**A**	14	Date and Time of transmission: formatted as YYYYMMDDHHMMSS. For example: 3:35 PM on March 1, 1995 would be represented using the following characters: 19950301153500.

Legend:		
	R Required	**D** Down Load
	O Optional	**U** Up Load
	I Ignored	**N** Never
	A Always	**S** Sometimes

Example Header Record Layouts (H)

Download	
Host	H I \ ^ I I I HOST I I I I I I I I I19950301153500<CR>
Upload	
***Analyzer* System**	H | \ ^ & | | | SHAnalyzer | | | | | | | | | 19950301154000<CR>

8.4 PATIENT RECORD (P)

Field	**Field Title**	**Down Load**	**Up Load**	**Max Len**	**Description and Valid Values**
1	Record Type ID	**R**	**A**	1	This is a required field that contains a "P" identifying it as a patient record.
2	Sequence Number	**R**	**A**	3	This field starts with a "1" for the patient and is incremented by 1 for each additional patient within the transmission.

3	Practice Assigned Patient ID	**R**	**A**	15	This field can be assigned by the instrument with no corresponding download.
4	Laboratory Assigned Patient ID	**I**	**N**		
5	Patient ID No. 3	**I**	**N**		
6	Patient Name	**O**	**S**	36	This field has two components: • Last Name (up to 20 characters) • First Name (up to 15 characters).
7	Mother's Maiden Name	**I**	**N**		
8	Birth Date	**O**	**S**	8	Formatted as YYYYMMDD: For example, a birth date of December 1, 1980 would be represented as: 19801201
9	Patient Sex	**R**	**A**	1	The valid values are: • M for Male • F for Female
10	Patient Race/Ethnic Origin	**I**	**N**		The *Analyzer* System will ignore this field at launch.
11	Patient Address	**O**	**S**	60	For ***Analyzer***, this is a four- component field: • Address (25 characters) • City (25 characters) • State (2 characters e.g.: NY, IT) • Zip (5 characters)
12	Reserved Field	**I**	**N**		
13	Patient Tel Number	**I**	**N**		
14	Attending Physician ID	**I**	**N**		
15	Special Field 1	**I**	**N**		
16	Special Field 2	**I**	**N**		
17	Patient Height	**I**	**N**		
18	Patient Weight	**I**	**N**		
19	Patient Known or Suspected Diagnosis	**I**	**N**		
20	Patient Active Medications	**I**	**N**		

21	Patient's Diet	**I**	**N**		
22	Practice Field No. 1	**I**	**N**		
23	Practice Field No. 2	**I**	**N**		
24	Admission Date and Discharge Date (if desired)	**O**	**S**	8	Admission date only. Formatted as YYYYMMDD.
25	Admission Status	**I**	**N**		
26	Location	**O**	**S**	20	
27	Nature of Alternative Diagnostic Code and classifiers	**I**	**N**		
28	Alternative Diagnostic Code and classification	**I**	**N**		
29	Patient Religion	**I**	**N**		
30	Marital Status	**I**	**N**		
31	Isolation Status	**I**	**N**		
32	Language	**I**	**N**		
33	Hospital Service	**I**	**N**		
34	Hospital Institution	**I**	**N**		
35	Dosage Category	**I**	**N**		

Legend:		
	R Required	**D** Down Load
	O Optional	**U** Up Load
	I Ignored	**N** Never
	A Always	**S** Sometimes

Example Patient Record (P)

	Download
Host	P | 1 | B108K | | | MW5910^Smith | | 19861002 | M | | Park Avenue^New York^NY^10002 | | | | | | | | | | | | 20020923 | | Hematology | | | | | | | | | |
***Analyzer* System**	P | 1 | B108K | | | MW5910^Smith | | 19861002 | M | | Park Avenue^New York^NY^10002 | | | | | | | | | | | | 20020923 | | Hematology | | | | | | | | |

8.5 TEST ORDER RECORD (O)

Field	Field Title	Down Load	Up Load	Max Length	Description and Valid Values
1	Record Type ID	**R**	**A**	1	This is required field that contains an "O" identifying it as an order
2	Sequence Number	**R**	**A**	3	This field starts with "1" for the first Test Order Record and is incremented by 1 for each additional Test Order Record within the record. This will be reset to "1" whenever another patient record is transmitted.
3	Specimen ID	**R**	**A**	15	Although the operator can manually edit this field at any time, the value of this field is usually assigned by the laboratory computer before down loading. The *Analyzer* uses and reports its results based on the assigned specimen ID.
4	Instrument Specimen ID	**I**	**N**		
5	Universal Test ID	**I** **I** **I** **R**	**N** **N** **N** **A**	9	This is a four-component field: • Universal Test ID Code (not used) • Universal Test ID Name (not used) • Universal Test ID Type (not used) • Manufacturer's or local code (6 characters): This is the code defined in the *Analyzer*.
6	Priority	**I**	**N**		
7	Request Ordered Date/Time	**I**	**N**		

8	Specimen Collected Date/Time	**I**	**N**		
9	Collection End Time	**I**	**N**		
10	Collection Volume/Units	**I**	**N**		
11	Collector ID	**I**	**N**		
12	Action Code	**I**	**N**		
13	Danger Code	**I**	**N**		
14	Relevant Clinical Info.	**I**	**N**		
15	Date/Time Specimen Received	**I**	**N**		
16	Specimen Type	**R**	**A**	1	This is a numeric field indicating the type of specimen: The Imm. System uses the following ASCII characters: **0**= Serum **1**= Urine
17	Ordering Physician	**I**	**N**		
18	Physician Tel. Number	**I**	**N**		
19	User Field No. 1	**I**	**N**		
20	User Field No. 2	**I**	**N**		
21	Lab Field No. 1	**I**	**N**		
22	Lab Field No. 2	**I**	**N**		
23	Date /Time Result Reported Last or Modified	**I**	**N**		

24	Instrument Charge	**I**	**N**		
25	Instrument Section ID	**I**	**N**		
26	Record Type	**I**	**A**	1	The field indicates the direction of the transmission: **O** - Down Loading **F** - Up Loading
27	Reserved Field	**I**	**N**		
28	Location or Ward of Specimen Collection	**I**	**N**		
29	Nosocomial Infection Flag	**I**	**N**		
30	Specimen Service	**I**	**N**		
31	Specimen Institution	**I**	**N**		

Legend:		
	R Required	**D** Down Load
	O Optional	**U** Up Load
	I Ignored	**N** Never
	A Always	**S** Sometimes

Example Test Order Record Layouts (O)

	Download
Host	O | 1 | AR102 | | ^^^GLU | | | | | | | | | | 0 | | | | | | | | | | O | | | | |
***Analyzer* System**	O | 1 | AR102 | | ^^^GLU | | | | | | | | | | 0 | | | | | | | | | | F | | | | |

8.6 RESULTS RECORD (R)

Field	Field Title	Down Load	Up Load	Max Len	
1	Record Type ID		**A**	1	This is a required field that contains an "R" identifying it as a Results Record.
2	Sequence Number		**A**	3	This field starts with "1" for the first result and is incremented by 1 for each additional result within the record. This will be reset to "1" when the results from another test order record are transmitted to the laboratory computer.
3	Universal Test ID	**I** **I** **I** **R**	**N** **N** **N** **A**	9	This is a four-component field: • Universal Test ID Code (not used) • Universal Test ID Name (not used) • Universal Test ID Type (not used) • Local Manufacturer's or local code (6 characters) this is the code defined in the *Analyzer*.
4	Data or Measurement value		**A**	10	'Data' is a 10-character, floating point field that includes the decimal point. The number of precision point digits will vary according to the test and is configurable on the *Analyzer*.
5	Units of Measure		**A**	6	This is a field for up to 6 characters that the operator defines for analytic measurement.
6	Reference Ranges		**A**	21	This field has two components; one giving the lower limit and the other the upper limit of the range. The format for this field is N^N.
7	Result Abnormal Flags		**A**	2	This field indicates the normal status of the result. The following codes are valid values: L - Below Low normal H - Above High normal LL - Below Panic normal HH - Above Panic normal

					< - Below absolute low (under linearity) > - Above absolute high (over linearity) N - Normal A - Abnormal E – Edited
8	Nature of Abnormality Testing		**N**		
9	Result Status		**A**	1	The Imm. System currently implements only two valid values: F - final results; V - operator verified/approved result.
10	Date of Change in Instrument Normative Values or Units		**N**		
11	Operator ID		**N**		
12	Date/Time Test Started		**N**		
13	Date/Time Test Completed		**A**	14	Date and Time of test completion: formatted as YYYYMMDDHHMMSS.
14	Instrument ID		**N**		
Legend:		**R** Required **O** Optional **I** Ignored **A** Always		**D** Down Load **U** Up Load **N** Never **S** Sometimes	

Example Result Record Layouts (R)

Upload	
Analyzer System	R | 1 | ^^^GLU | 70.97 | UL | 70^105 | N | | F | | | | 20020923114302 |

8.7 MESSAGE TERMINATOR RECORD (L)

Field	Field Title	Down Load	Up Load	Max Len	Description and Valid Values
1	Record Type ID	**R**	**A**	1	This is a required field that contains an "L" identifying it as an Message Terminator Record.
2	Sequence Number	**R**	**A**	1	For a message terminator, this message should always be "1".
3	Termination Code	**R**	**A**	1	This indicates the cause of termination. The following codes are valid values for the *Analyzer* : Null or **N**-normal termination

Legend:		
	R Required	**D** Down Load
	O Optional	**U** Up Load
	I Ignored	**N** Never
	A Always	**S** Sometimes

Example Message Terminator Record Layout (L)

Host	L I 1 I N
***Analyzer* System**	L I 1 I N

8.8 REQUEST INFORMATION RECORD (Q):

Field	Field Title	Down Load	Up Load	Max Len	Description and Valid Values
1	Record Type ID		**A**	**1**	This is a required field that contains a "Q" identifying it as a request.
2	Sequence Number		**A**	**1**	It is always "1".
3	Starting Range ID Number		**A**	**31**	This field can either be: "ALL" - to mean all demographics and tests being ordered should be sent to the instrument at this time, or can have two components: • Computer system patient ID No. (up to 15 characters); • Computer system specimen ID No. (up to 15 characters).

4	Ending Range ID Number		**N**		
5	Universal Test ID		**N**		
6	Nature of Request Time Limits		**N**		
7	Beginning Request Results Date and Time		**N**		
8	Ending Request Results Date and Time		**N**		
9	Requesting Physician Name		**N**		
10	Requesting Physician Telephone Number		**N**		
11	User Field No. 1		**N**		
12	User Field No. 2		**N**		
13	Request Information Status Codes		**A**	**1**	It is always "O" (requesting test orders and demographics only).

Example Request Information Record Layouts (Q)

	Download To
Analyzer System	H | \^& | | | SHAnalyzer | | | | | | | | | 20020927100402 Q | 1 | ALL | | | | | | | | | | O L | 1 | N

CHAPTER 09

- ERROR SIGNALING AND TROUBLESHOOTING -

INDEX

9.1 ERROR SIGNALING……..……..2

9.1.1 SYSTEM ERRORS 2

9.1.2 RESULT FLAGS.....3

9.1.3 DESCRIPTION OF RESULT FLAGS.....4

9.2 TROUBLESHOOTING GUIDE 7

9.1 ERROR SIGNALLING

This chapter is dedicated to a description of the **error** signalling which may occur during the programming or carrying out of the various operations. Error signals can be divided into the following two groups:

- ➢ System Errors
- ➢ Result Flags

9.1.1 SYSTEM ERRORS

Whenever a system error is detected, it is signalled via the activation of the below-listed warning lights/buttons:

➢ **Warning** Light: a triangle-shape located in the upper, right-hand portion of the System Monitor screen. It lights up yellow when activated.
If this yellow triangle does light up, the operator need simply click on it to access the relative visual text warning message indicating the cause of the signalled anomaly (said window will open in that area dedicated to viewing data).
Following is a list of possible visual text "Warning!" messages:

- Liquid Alarm I (Rinse Solution)
- Liquid Alarm II (Distilled Water)
- Liquid Alarm III (Cleaning Solution)
- Temperature Out-of-Range
- Host Serial Port cannot be opened

➢ **Fatal Error**: an "X"-shape located in the upper, right-hand portion of the System Monitor mask. It lights up red when activated.
If this red "X" lights up, the operator need simply click on it to access the relative visual text message explaining the cause of the Fatal Error (said window will open in that area of the mask dedicated to viewing data).

Following is a list of possible Fatal Error visual text messages:

- Error on Internal Arm
- Error on External Arm
- Filter Error
- ADC Error – Sample Channel
- ADC Error – Reference Channel
- Reaction Tray Position Error
- Plate Error (Home sensor not found)
- Arm Vertical error
- Cuvette lock Error

- Wash System Error
- Diluter Error
- Interlock Open while Instrument is running
- Macro send Error
- Overflow Rx Buffer Micro
- Time out Error (Generic error)
- Invalid command error
- Invalid parameter error
- Check sum error

9.1.2 RESULT FLAGS

Result Flags are categorized under the following group headings, Each group is identified by a symbol, as listed here-below:

X	**PHYSICAL ERRORS**
R	**CONCENTRATION ERRORS**
C	**CALIBRATION ERRORS**
A	**OPTIC DENSITY ERRORS**
E	**RESULTS EDITED MANUALLY**
I	**ISE MODULE ERRORS**
?	**PROGRAMMING ERRORS**

Every Result Flag, signalling an error, is accompanied by a symbol representing the group it is part of. The operator need only click on the small red square ( ) next to the Result Flag symbol to access the visual text message explaining the cause(s) of the signalled error.

In the central column of the following tables, the user will find those symbols which signal the type of error encounter, as used in the print-out of the final report. These symbols can be modified by the operator, in the **Parameters** section, under **print options**.

WARNING! The use of the Error Symbols in the print-out of the results (inclusion and/or exclusion) **IS UNDER THE DIRECT AND SOLE RESPONSIBILITY OF THE USER**

9.1.3 DESCRIPTION OF RESULT FLAGS

➢ X Physical Errors

Temperature Error:	**T**	Reaction temperature (Reaction Plate) is out-of-range.
No Sample	**S**	Either no sample or sample serum quantity below minimum or above maximum level for the declared container.
No Reagent:	**R**	Either no reagent or reagent level below minimum or above maximum level for the declared container.
No Rack:	*****	No Rack present during sampling.

➢ R Concentration Errors

Very Low and Very High:	**L-H**	Flags determined by test results out-of-range as setup in the Methods.
Low Alert and High Alert:	**A**	Flags determined by test results out-of-range as setup in the Methods.
Low and High Linearity Limit:	**G**	Flags determined by test results out-of- range as setup in the Method.
Calculation Error:	**C**	Concentration calculation error due to foreseeable causes (Asymptote).

➢ C Calibration Errors

RBL missing:	*****	No Reagent Blank Level.
Calibration missing:	*****	No Standard or no Calibration curve.
STD Replicate insufficient:	*****	Insufficient number of valid Standard Replicates.
STD Replicate outside CV%:	*****	Coefficient of Variation Percentage in the Standard Replicates over the set value
Invalid Calibration:	*****	Calibration curve not valid – either because it is not monotonic or because the Fit is above the set value.

➢ A Optic Density Errors

Inversion:	**I**	Reaction direction not in line with that set-up.
End Point Limit:	**P**	Values over the limits setup in the Methods Parameters
Depletion Limit:	**D**	Values over the limits setup in the Methods Parameters.
First Limit:	*	Values over the limits setup in the Methods Parameters
FIT:	**F**	Values over the limits setup in the Methods Parameters.
RBL out-of-range:	*	Reagent Blank Levels outside the range Setup.
Sample outside Standard:	#	Sample absorbance outside the calibration curve.

➢ E Results Edited Manually

Results Edited:	**E**	This symbol automatically appears whenever the operator has manually modified the obtained results. This operation annuls all the symbols indicating errors which, in this case, will not be viewed.

➢ I ISE Module Errors

Air in the ISE Module:	*	Air present in the ISE Module hydraulic circuit.
Calibrate A drift:	*	Calibrate A drift in the ISE Module.
Noise in the ISE Module:	*	Background noise present – values not reliable.
Out-of-Range in ISE Module:	*	Linearity values out-of-range.

➢ ? Programming Errors

All those software errors which are deemed unforeseeable are indicated using this symbol.

➢ Result Asterisks

In the event that the following situations and/or error conditions occur, the system will notify the user via a visualization of two asterisks **(**)** in the Results field:

PHYSICAL ERRORS

1 – very little or no sample

2 – very little or no reagent

3 – no rack

CONCENTRATION ERRORS

4 – calculation error

5 – signalling depletion limit

PROGRAMMING ERROR

6 – all cases

In the following situations and/or error conditions, the results field will contain a "0":

1 – if the result is less than zero

2 – if the result is equal to zero

OPTIC DENSITY ERRORS

3 – Flag signalling inversion

9.2 TROUBLESHOOTING GUIDE

PROBLEM	➢ POSSIBLE CAUSE	❖ SOLUTION
Repeatability of results insufficient	➢ Sample Probe dirty ❖ Clean the Sample Probe as described in Chapter 07 Maintenance ➢ Hydraulic leak and/or air bubble in the hydraulic circuit (sampling) ❖ Check Sample Probe fit ❖ Check the fit of the hydraulic tubes and their connection: if necessary, substitute the tubes and/or adjust their connections/fittings ➢ Wash solution is contaminated. If the wash solution contains contaminating particles (e.g.: mold, dust, lint), these micro-particles can cause errors during the WBL running. ❖ Change the wash solution ❖ Clean the Wash Solution Bottle(s) and carry out the Hydraulic Circuit wash procedure as described in Chapter 07 – Maintenance ➢ Deterioration of the Reagent(s) ❖ Substitute the bad reagent(s) ➢ Reaction cuvettes not dried correctly after being washed ❖ Check the Tip used to dry the cuvettes after washing to make sure it is in good working condition. If necessary, clean the Tip or change it, following the procedure described in Chapter 07 – Maintenance ➢ Light bulb not stable ❖ Light bulb nearing the end of its 2000-hour life cycle duration, or premature deterioration. In both cases, change the light bulb following the substitution procedure described in Chapter 07 – Maintenance.	
Insufficient volume/quantity of the various Rinse, Cleaning and Distilled Water solutions.	➢ This type of problem can present itself either when the instrument is first turned on due to a lack of liquid in one or more bottles, or during test running whenever the involved liquid has been finished ❖ Refill the required bottle. If the instrument is running tests, it will automatically **Pause**. Wait until sampling is suspended, then refill the involved bottle with the required liquid (Rinse/Cleaning/ Distilled Water). Press *Start* to continue running the rest of the programmed tests. This operation will not adversely affect the already run tests.	

CHAPTER 10

– ISE MODULE -

INDEX

10.1 ELECTROLYTE MEASUREMENT SYSTEM 2
10.1.1 PRODUCT DESCRIPTION 2
10.2 ELECTROLYTE MEASUREMENT SYSTEM FEATURES AND BENEFITS 3
10.3 TECHNICAL SPECIFICATION 4
10.4 SYSTEM OPERATION – ISE THEORY 5
10.5 MECHANICAL FEATURES 6
10.6 ELECTRODES 7
10.7 FLUID MANAGEMENT 8
10.7.1 REAGENT USED 8
10.7.2 REAGENTS, CALIBRATION AND SAMPLE PROCESSING 9
10.8 ELECTRONICS 11
10.8.1 GENERAL DESCRIPTION 11
10.9 MAINTENANCE 11
10.10 TROUBLE SHOOTING GUIDE 12

10.1 ELECTROLYTE MEASUREMENT SYSTEM

10.1.1 PRODUCT DESCRIPTION

Electrolyte Measurement System includes a small, simple, and reliable ISE module and two peristaltic pumps designed to be mounted within a existing chemistry analyzer. The module measures the concentration of Sodium, Potassium and Chloride. The module contains an integral sample entry port, positioned at the top. The compact design allows for small sample size and fast operation. The modules requires only a 70 µl sample.

The module housing contains snap-in, snap-out ISE sensor which, through simple connectors, connect directly to an electronic board in close proximity to the module. This eliminates the need for cables and maximizes noise immunity. Samples and calibrators are positioned within the module by two snap-in, snap-out peristaltic pump cassettes. The waste pump positions the sample in front of the sensor for measurement. After sample measurement, a calibrant/wash solution is pumped in front of the sensor for a single point calibration.

Provision for two-point sensor calibration and cleaning are made through use on the analyzer sample tray which serve as reservoirs for the second calibrator and cleaning solution.

The module is completely self-contained. All sample and calibrant positioning within the module is controlled by an integral microprocessor, which assure reliable electrode operation and maximum lifetime.

10.2 ELECTROLYTE MEASUREMENT SYSTEM FEATURES AND BENEFITS

Features	Benefits
Integral Sample Entry port	Minimal Sample Carry Over
Small Sample Size	70 ul
Electrodes Mounted Close to Electronics	Minimal electronic noise improves precision
Sample Port Adjacent to ISE Sensor	Minimal Sample Size and Carry Over
Rapid Operation (30 Sec Cycle Time)	Rapid electrolyte results
Easy to access sensors	Simple Maintenance
No membranes	Maintenance performed by lab personnel
Easily accessed pumps	Simple maintenance
Two bubbles detectors	Reliable sample processing assured
Two point calibration	High accuracy and precision
One point calibration with every sample	High accuracy and precision
Maintenance free electrodes (6 month or 10.000 sample warranty)	Low cost per test
Disposable reference electrode, no addition of filling solution required	Convenaient maintenance

10.3 TECHNICAL SPECIFICATION

Sample: Whole Blood, Serum, Plasma or Urine

(Urine requires dilution 1:10)

Sample Size: 70 ul, (3 channels) serum; 160 ul undiluted urine

Reproducibility:	Maximum imprecision (within run)	Typical Carry Over, % (Serum)
Sodium	CV<1,5% (100 - 160 mmol/L)	<0,5%
Potassium	CV<2% (3,00 - 6,00 mmol/L)	<1,5%
Chloride	CV<2% (80,0 - 120,0 mmol/L)	<1,0%

Analysis Time: Serum – 30 seconds, including one point calibration
Urine – 60 seconds, including one point calibration

Throughput: Serum – 120 sample/hour
Urine – 60 sample/hour

Reagents: Calibrant “A”
Calibrant ”B”
Cleaning Solution
Urine Diluent

Maximum Environnemental Temperature: 38°C

(Host Analyzer requires working temperature within: 18°C $\leq$ **T** $\leq$ 32°C)

10.4 SYSTEM OPERATION – ISE THEORY

Electrolyte Measurements System measure sodium, potassium and chloride in biological fluids, using ion selective electrode technology. The flow-through sodium electrode selective PVC membrane tubing, specially formulated to be sensitive to sodium ions. The potassium and chloride electrodes employ similar designs with appropriate selective membrane materials. The potential of each electrode is measured relative to a fixed, stable voltage established by the double-junction silver/silver chloride reference electrode. An ion selective electrode develops a voltage that varies with the concentration of the ion to which it responds. The relationship between the voltage developed and the concentration of the sensed ion is logarithmic, as expressed by the Nerst equation:

$E = E° + RT \log (\varepsilon C)/nF$

Where:

E = The potential of the electrode in sample solution

E°= The potential developed under standard conditions

RT/nF = A temperature dependent "constant", termed the slope(s)

Log = Base ten logarithm function

ε = Activity coefficient of the measured ion in the solution

C = Concentration of the measured ion in the solution

A comparative method of measurement is utilized. First, the ISE module measures the potential developed when the sample is positioned in the electrodes. Next, Calibrant A is positioned in the electrodes. The difference in the two potentials is related logarithmically to the concentration of the measured ions in the sample divided by their respective concentrations in the Calibrant solution. Since the difference in potentials and the concentration of the sodium, potassium or the other ions in the Calibrant solution are known, the computer can calculate the concentration of the ions in the sample solution, in accordance with the Nerst equation, rewritten as:

$E - E° = S \log (C_x/C_s)$ or $C_x = C_s \times 10^{\wedge} [(E - E°)/S]$

Where:

E = ISE potential developed in sample solution

E° = ISE potential developed in the Calibrant solution

S = Electrode slope calculated during calibration

C_x = Concentration of ion in the sample

C_s = Concentration of ion in the Calibrant solution

"S", the slope, is determined during calibration using Calibrants A and B, which have known levels of sodium, potassium, and chloride. When an automatic calibration is initiated, the slope is calculated between the second Calibrant A reading and the Calibrant B reading.

Excessive drift or noise reading will be flagged and the appropriate error message sent to the host analyser from the ISE Module.

10.5 MECHANICAL FEATURES

The electrode housing contains each of the ion-selective electrodes, as well as the reference electrode.

Two bubble detectors are also included at both the top and bottom of the electrode chain. These are used to properly position the sample for measurement. A sample port is positioned directly above the chain of electrodes on the top of the module.

An electronic signal processing board is attached to the electrode housing. This board includes high input impedance operational amplifiers to detect the ISE signals and additional digital processing circuitry serving as an A/D converter and providing an ASCII signal output to the chemistry analyser.

Each of the electrodes can be easily removed from the front of the housing.

10.6 ELECTRODES

The electrodes are maintenance-free and are warranted on a prorated basis for up to 10,000 samples or 6 months, whichever occurs first. Cleaning Solution, aspirated from an operator designed sample cup, is used at least once a day at the end of the day in order to minimize protein build-up in the fluid lines. A two-point calibration of the ISE module is also done at least once a day at the beginning of the first sample run. If the user is running more than 50 samples a day, both cleaning and calibrant must be performed after 8 hours by the host analyzer.

The entire double-junction reference electrode is disposable. The reference electrode is filled with sufficient KCL so that no filling solution must be added during the lifetime of the electrode.

Electrodes require calibrant sampling at 30 minutes intervals for reliable operation, but this is completely controlled by the Electrolyte Measurement System without any need for control by the host analyzer or the operator.

The electrodes require a 10 times sample dilution for measurement of urine.

The ISE module depends on the host analyzer to perform the dilution function.

It is not necessary to regulate the electrode housing temperature provided that its environmental temperature does not exceed 38° C. However, the electrode module should not be subject to changes greater than plus or minus 8° C without recalibrating.

10.7 FLUID MANAGEMENT

10.7.1 REAGENT USED

The sample is aspirated from a sample cup and dispensed into the sample port at the top of the ISE module. The sample is then positioned in front of the sensor using the bubble detector and the Waste Pump.

Four reagents are needed to operate the ISE module.

Calibrant "A":

Used as wash solution and single-point calibrator. Calibrant A is pumped into the sample port by the Calibrant A pump and then positioned in front of the sensors

Calibrant "B":

Used as the second point in two-point calibration. Calibrant B is aspirated from a cup on the analyzer at least once a day or every 8 hours, depending upon the laboratory schedule.

A volume of 500 ul is sufficient for one day's requirements.

The Calibrant "B" must be placed on the system just before use to prevent a change in values from evaporation.

Cleaning Solution:

Should be run once a day to prevent protein built up or at 8 hours intervals if the ISE Module performs greater than 50 samples per day

Cleaning Solution may be aspirated from a sample cup; 500 ul is sufficient for one day's requirements.

Urine Diluent:

This is required for urine samples. Urine samples must be diluted manually by a factor of 10 to perform urine measurement.

10.7.2 REAGENTS, CALIBRATION, AND SAMPLE PROCESSING

The sequence of use of Calibrant A and patient samples during processing is as follows:

1. Sample deposited into ISE Module sample port by host analyzer;
2. Sample positioned in front of electrodes of Electrolyte Measurement System by the waste pump;
3. Sample equilibration and reading occurs during 7 second period;
4. Calibrant A pumped into electrode module;
5. Calibrant A equilibration and reading occurs during 7 second period;
6. Results transmitted to the host analyzer;
7. ISE module ready for next cycle.

Pumpings of a small amount of Calibrant A are performed when the Electrolyte measurement System is in "Standby" or when it is not being used in the "Sample" mode. This significantly improves the performance of the electrodes. The Electrolyte measurement System must always be supplied with power so that "pumping" can occur. Pumping occurs automatically, without prompting by the host analyzer, beginning 30 minutes after the last sample or calibration was performed.

During sample processing, a volume of 200 µl of Calibrant A solution is used for one point calibration, sample, wash, and cleaning. A volume of 120 µl is used for each sip.

The Electrolyte Measurement System should perform a two points calibration at the beginning of the sample run. If the user is running more than 50 sample a day, both cleaning and calibration must be performed after 8 hours by the host analyzer. 140 µl of Calibrant B solution are used during two point calibration. During two points calibration, electrode calibration slopes are transmitted by the module for QC purpose and may be used by the operator to diagnose module performance. The slope is defined as:

$$\text{Slope} = (E_B - E_A) / \log (C_B / C_A)$$

Where:

C_A = Calibration A concentration in mmol/L

C_B = Calibration B concentration in mmol/L

E_A = ISE potential developed in Cal A solution in mV

E_B = ISE potential developed in Cal B solution in mV

These slopes are checked by the module's electronic processor and an error code will be transmitted if they are outside the required range.
Typical slopes are approximately 55mV/decade for Na and K and 45mV/decade for Cl.

Acceptable limit slopes are:

Slope (mV/decade)		Range (mmol/L)		
			Serum	Urine
Na	50-63	Na	20-200	20-1000
K	50-63	K	0,2-20,0	1-50
Cl	40-59	Cl	25-200	20-500

10.8 ELECTRONICS

10.8.1 GENERAL DESCRIPTION

ISE module electronics include all pre-amplifiers and perform microprocessor control of the fluid pumps, A/D conversion and RS-232C communications. The microprocessors apply proprietary mathematical algorithms to electrolyte sensor output voltage, converting them to clinical units of mmol/L.

Sensor Inputs:

- Na Electrode;
- K Electrode;
- Cl Electrode;
- Reference Electrode;
- Upper Bubble Detector;
- Lower Bubble Detector.

10.9 MAINTENANCE

The Electrolyte Measurement System has been designed to require very little operator maintenance.

The only daily maintenance required is to run the Cleaning Solution after the last sample of the day.

REPLACEMENT/PART	3 MO	6 MO	9 MO	12 MO
Pump Tube		X		
Na Electrode		X		
K Electrode		X		
Cl Electrode		X		
Reference Electrode		X		
Reagents	Refill REAGENT as required by testing needs			

Recommended Maintenance/Replacement Schedule (more than 100 samples per day)

REPLACEMENT/PART	3 MO	6 MO	9 MO	12 MO
Pump Tube		X		
Na Electrode	10.000 samples			
K Electrode	10.000 samples			
Cl Electrode	10.000 samples			
Reference Electrode	10.000 samples			
Reagents	Refill REAGENT as required by testing needs			

10.10 TROUBLE SHOOTING GUIDE

SYMTOM	PROBLEM	CORRECTION
System does not respond	1. RS232 cable is disconnected or damaged.	Reconnect or replace cable
	2. Module connector has been damaged.	Replace board
	3. Component failure on board.	Replace board.
Low Slope: Na or K <45mV/decade, Cl<35 mV/decade or **High Slope:** Na or K>63mV/decade, Cl>60 mV/decade	1. Misalignment of sensors.	Remove and replace sensors to re-seat.
	2. Deterioration of calibrator solutions	Replace Cal B first and retest. If still low, replace Cal A and retest.
	3. Deterioration of sensing electrode.	Replace problem sensor and test
	4. Air bubble on Reference Electrode membrane.	Remove electrode, tap to dislodge bubble, replace, and recalibrate.
	5. Deterioration of reference electrode.	Replace reference electrode and retest.
	6. Interaction between sensing electrodes	Replace Cl electrode only and retest.
	7. Temperature of the module or liquid higher than 37° C.	Check the temperature and if necessary change location
Noise error Flag Single electrode	1. Deterioration of sensing electrode	Replace problem sensor and test
	2. Electrical noise spike from environmental source	a) Check that motor or solenoid valve near module is not activated during the read portion of the module cycle. b) Component failure on module board. Replace board.
Noise Error Flag Multiple electrodes	1. Deterioration of reference electrode	Replace reference electrode and retest.
	2. Electrical noise spike from environmental source	a) Check that motor or solenoid valve near module is not activated during the read portion of the module cycle. b) Component failure on module board. Replace board.

Drift Error Flag Single electrode	1. Deterioration of sensing electrode	Replace problem sensor and test.
	2. May occur when new sensor or new bottle of Cal A is installed on system.	Purge the Cal A and recalibrate the module. If the sensor is new it may initially drift as it rehydrates over the course of 15 minutes.
Drift Error Flag Multiple electrodes	1. Deterioration of Reference electrode	Replace reference electrode and retest
	2. Electrical spike from environmental source	a) Check that motor or solenoid valve near module is not activated during the read portion of the cycle.
		b) Component failure on module board. Replace the board.
	3. May occur when new sensor or new bottle of Cal A is installed on system.	Purge the Cal A and recalibrate the module.
Air in Sample	1. Insufficient sample pipetted into module sample port	a) Host instrument must deliver 70 ul. Increase dispensed volume b) Insufficient sample in sample cup for all tests programmed.
	2. Sample not positioned properly.	a) Pumps not connected properly. b) Pump tubing obstructed or tubing length is excessive.
Air in Sample and Cal A	1. Sample and Cal A are segmented with air.	a) Sensors are not properly compressed. Check compression plate, spring and seal. b) Ensure that all sensor and o-rings are in place.
	2. Fibrin or salt is plugging the sensor flow path	c) Use Cleaning procedure <CLEN> for module d) Disassemble module and clean or replace sensor with plugged flow path.
	3. Air Bubble Detector failure	Replace air bubble detector
	4. Waste Pump failure	Replace the waste pump.

Air in Cal B and in Cal A	1. Cal B and Cal A are segmented with air.	a) Sensors are not properly compressed. Check compression plate, spring and seal. b) Ensure that all sensor and o-rings are in place.
	2. Fibrin or salt is plugging the sensor flow path	a) Use Cleaning procedure <CLEN> for module b) Disassemble module and clean or replace sensor with plugged flow path.
	3. Waste Pump failure.	Replace the waste pump.
	4. Air Bubble Detector failure.	Replace air bubble detector.
Air in Cal B	1. Insufficient Cal B pipped into module sample port	a) Host Instrument must deliver 70 µl. Increase dispensed volume b) Insufficient sample in sample cup for all tests programmed.
	2. Sample not positioned properly.	a) Pumps not connected properly. b) Pump tubing obstructed or tubing length is excessive for spring and seal.
Air in Cal A (no "Air" errors reported for Sample or Cal B)	1. Cal A bottle is empty	Replace Cal A bottle with a new one and recalibrate.
	2. Tubing is disconnected.	Reconnect or replace tubing
	3. Cal A pump is not working properly.	a) Check electrical connections. b) Replace pump cassette. c) Replace motor.
	4. Tubing is plugged, split or crimpted.	Replace tubing.